OPERATING INSTRUCTIONS

FLOWSIC500
Ultrasonic Gas Flow Meter with Optional Volume Conversion

Installation
Operation
Maintenance

SICK
Sensor Intelligence.

Document Information

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Original Documents
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Glossary

AC	Alternating Current
Al	Aluminium
ATEX	ATEX: Atmosphères Explosifs: Abbreviation for European standards that govern safety in potentially explosive atmospheres
CSA	Canadian Standards Association (www.csa.ca)
DC	Direct Current
HF	High frequency, e. g. HF pulses
IEC	International Electronical Commission
IECEx	IEC system for certification in accordance with standards for devices for use in potentially explosive atmospheres
IP*xy*	Ingress Protection: Degree of protection of a device in accordance with IEC/DIN EN 60529; *x* specifies the protection against contact and impurities, *y* protection against moisture.
LF	Low frequency, e. g. LF pulses
MDR	Manufacturer Data Record
NAMUR	Abbreviation for "Normen-Arbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie", now "Interessengemeinschaft Automatisierungstechnik der Prozessindustrie" (www.namur.de)
pTZ	Volume conversion as a function of the pressure, the temperature and with consideration of the compression factor
TZ	Volume conversion as function of the temperature and a fixed pressure value and with consideration of the compression factor

Warning Symbols


IMMEDIATE HAZARD
of severe injuries or death


Hazard (general)


Hazard by electrical voltage

Hazard in potentially explosive atmospheres


Hazard by explosive substances/mixtures


Hazard by unhealthy substances


Hazard by toxic substances

Warning Levels / Signal Words

DANGER
Risk or hazardous situation which *will* result in severe personal injury or death.

WARNING
Risk or hazardous situation which *could* result in severe personal injury or death.

CAUTION
Hazard or unsafe practice which *could* result in personal injury or property damage.

NOTICE
Hazards which *could* result in property damage

Information Symbols

Information on product condition with regard to protection against explosions (general)


Information on product characteristics related to European Directive 94/9/EC (ATEX)

Information on product characteristics related to explosion protection in accordance with the IECEx scheme.


Important technical information for this product


Important information on electric or electronic functions


Nice to know


Supplementary information


Link referring to information at another place

FLOWSIC500

1 Important Information

Main hazards
About this document
Intended use
Responsibility of user

1.1 Main hazards

DANGER: Risk of explosion when the gas flow meter is damaged

Natural gas flows with line pressure through the gas flow meter. Natural gas can escape when the gas flow meter is damaged which creates a risk of explosion.

- ► Prevent any possible damage to the gas flow meter. When necessary, fit protection devices.
- ► If the gas flow meter is damaged: Stop natural gas feed immediately and purge the FLOWSIC500 with inert gas.

WARNING: Hazards through leaks

Operation in leaky condition is not allowed and potentially dangerous.

- ► Regularly check leak tightness of equipment.

1.2 About this document

This Manual describes:

- Device components
- Installation
- Operation of the FLOWSIC500.

It contains the main safety information for safe operation of the FLOWSIC500.

Scope of document

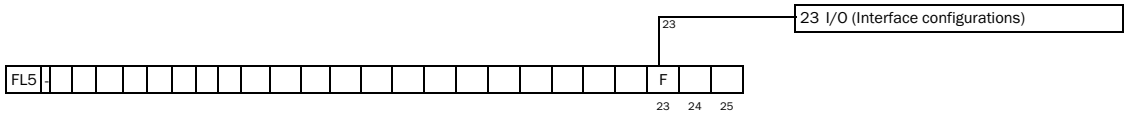
NOTICE: **Interface Configurations**

This document only applies to FLOWSIC500 gas flow meters with optically isolated inputs and outputs.

Make sure that your FLOWSIC500 is equipped with optically isolated inputs and outputs:

- ► Check the type code, position 23 "I/O", on the type plate (→ Fig. 2) of your FLOWSIC500:
  - FLOWSIC500 with interface configurations F, G H, I and J have optically isolated inputs and outputs.
  - For information on FLOWSIC500 with interface configurations A, B, C, D and E, please refer to document "8018707, Addendum to Operating Instructions FLOWSIC500: Interface Configurations".

Fig. 1 Type code



- ► For a complete description of the type code refer to → p. 112, §9.2.

1.3 Intended use

1.3.1 Purpose of the device

The FLOWSIC500 serves for measuring the gas volume, volume flow rate and gas velocity of natural gas in pipelines.

The FLOWSIC500 with optional volume conversion serves for measuring the gas volume and converting the gas volume measured to base conditions as well as registering data on meter readings, maximums and other data.

1.3.2 Product identification

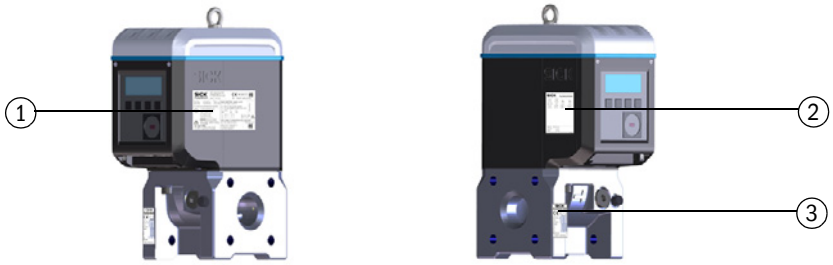
Product name:	FLOWSIC500
Manufacturer:	SICK AG Erwin-Sick-Str. 1 79183 Waldkirch Germany
Place of manufacture:	SICK Engineering GmbH Bergener Ring 27 01458 Ottendorf-Okrilla Germany

The type plates for metrological and electrical parameters are located on the gas flow meter. The type plate for the Pressure Equipment Directive is located on the adapter.

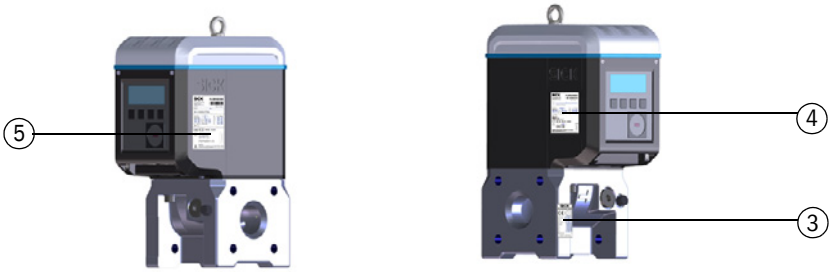
Examples for the type plates see → p. 114, § 9.3.

Fig. 2 Location of type plates

Labelling according to ATEX/IECEx



Labelling according to CSA



1 Type plate, metrological and electrical parameters (metrology and electronics)
2 Pin assignment of plug-in connectors
3 Type plate PED
4 Type plate, electrical parameters (electronics)
5 Type plate, metrological parameters (metrology)

1.3.3 Operation in potentially explosive atmospheres

The FLOWSIC500 is suitable for use in potentially explosive atmospheres:
ATEX: II 2G Ex ia [ia] IIB T4 Gb, II 2G Ex ia [ia] IIC T4 Gb, II 2G Ex op is IIC T4 Gb
IECEx: Ex ia [ia] IIB T4 Gb, Ex ia [ia] IIC T4 Gb, Ex op is IIC T4 Gb
US/C: Class I Division 1, Groups C, D T4, Ex/AEx ia IIB T4 Ga

Further information on potentially explosive atmospheres → p. 37, §3.4.1.

1.3.4 Combustible gas

► The FLOWSIC500 is suitable for measuring combustible and occasionally ignitable gases corresponding to zones 1 and 2.

1.3.5 Restrictions of use

► Refer to the type plate for the configuration of your FLOWSIC500.
► Check the FLOWSIC500 is suitably equipped for your application (e.g. gas conditions).

WARNING: Hazard through material fatigue
The FLOWSIC500 has been designed for use under mainly static loads.
► Maximum allowed gradient of static pressure: 3 bar/s (45psi/sec)
The number of complete pressure application and release processes should be kept low during operation.
► Replace the device when 500 cycles have been reached.

NOTICE:
The FLOWSIC500 is designed for measuring clean and dry natural gas.
► The operator should install a suitable filter or cone screen ahead of the gas flow meter when the gas is contaminated.

NOTICE:
- The FLOWSIC500 is suitable for use in pressurized lines within the parameters specified in the device. The device complies with Pressure Equipment Directive 97/23/EC.
- It is the user's responsibility to ensure the maximum values specified for pressure and temperature on the type plate are not exceeded during operation.

1.3.6 Cleaning

WARNING: Risk of ignition due to electrostatic charge

Under certain extreme circumstances, in Gas Group IIC, exposed plastic and unearthed metal parts of the enclosure may store an ignition-capable level of electrostatic charge.

► Implement precautions to prevent the build up of electrostatic charge, e.g. locate the equipment where a charge-generating mechanism (such as wind-blown dust) might occur and clean with a damp cloth.

***NOTICE:* Cleaning instructions**

► Only clean the FLOWSIC500 with a damp cloth.

► Do not use solvents for cleaning.

► Only use materials for cleaning which do not damage the surface of the FLOWSIC500.

1.4 Responsibility of user

► Only put the FLOWSIC500 into operation after reading the Operating Instructions.

► Observe all safety information.

► If anything is not clear: Please contact the SICK Customer Service.

Designated users

The FLOWSIC500 may only be operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

NOTICE:

Skilled persons are persons in accordance with DIN VDE 0105 or IEC 364, or directly comparable standards.

These persons must have exact knowledge on hazards arising from operation, e.g. through hot, toxic, explosive gases or gases under pressure, gas-liquid mixtures or other media as well as adequate knowledge of the measuring system gained through training.

Correct use

► Only use the FLOWSIC500 as described in these Operating Instructions (→ p. 11, § 1.3.1). The manufacturer bears no responsibility for any other use.

► Do not carry out any work or repairs on the FLOWSIC500 not described in this manual.

► Do not remove, add or change any components in or on the FLOWSIC500 unless such changes are officially allowed and specified by the manufacturer.

Otherwise

- Any warranty by the manufacturer becomes void
- The FLOWSIC500 can become dangerous
- The approval for use in potentially explosive atmospheres is no longer valid
- The approval fur use in lines pressurized above 0.5 bar (7.25 psi) bar is no longer valid.

Danger identification on device

WARNING: Danger identification on device
The following symbol draws attention to important dangers directly on the device:

► Consult the Operating Instructions in all cases where the symbol is attached to the device or shown on the display.

Special local conditions

► Follow all local laws, regulations and company-internal operating directives applicable at the installation location.

Retention of documents

These Operating Instructions must be

► Kept available for reference

► Passed on to new owners.

1.5 Additional documentation/information

Some parameter settings, components and characteristics depend on the individual device configuration. This individual device configuration is described in the device documentation delivered with the device.

- Certificate of conformity/EX certificates (depending on configuration)
- Material certificate
- Inspection certificate
  - Device configuration sheet
  - Encoder test protocol (if configured)
  - Low-pressure calibration test protocol (if ordered)
  - Labels according to Pressure Equipment Directive 97/23/EC, Annex 1 Part 3.3
- Printout of the Data Book
- Product CD with:
  - Operating Instructions
  - Operating program FLOWgate500
  - FLOWgate500 Software Manual
  - Key code
  - Instructions for Kamstrup test valve BDA04

FLOWSIC500

2 Product Description

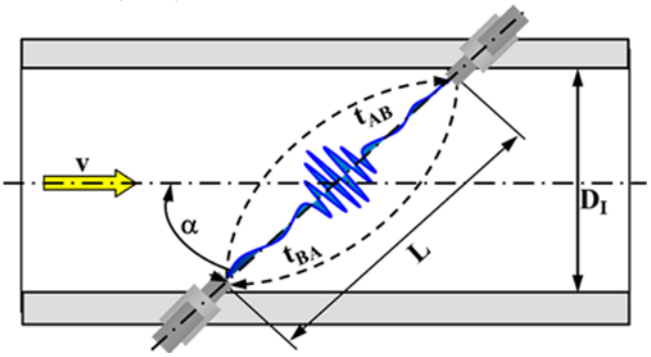
Operating principle
Device components
Meter sizes
Power supply
Interfaces
Device option: Volume conversion
Totalizers
Logbooks and Archives
Parameter protection
Sealing

2.1 Operating principle

2.1.1 Gas flow meter

The FLOWSIC500 works according to the principle of ultrasonic transit time difference measurement.

Fig. 3 Functional principle



v = Gas velocity
L = Measuring path
α = Angle of inclination in °
t_{AB} = Sound transit time in flow direction
t_{BA} = Sound transit time against flow direction
D_I = Pipe inner diameter
Q = Volume flow

Measured signal transit times t_{AB} and t_{BA} are defined by the current sound and gas velocity.

Gas velocity v is determined from the difference between the signal transit times. Therefore changes in the sound velocity caused by pressure or temperature fluctuations do not affect the calculated gas velocity with this measurement method.

The FLOWSIC500 calculates the volume flow rate internally from the gas velocity and the diameter of the measuring section of the gas flow meter.

$$Q = \frac{\pi}{4} D_I^2 \cdot \frac{L}{2\cos\alpha} \cdot \frac{t_{BA} - t_{AB}}{t_{AB} \cdot t_{BA}}$$

2.1.2 Volume conversion (optional)

The integrated volume conversion converts the measured gas volume from measurement conditions to base conditions.

Calculation according to EN 12405:

$$V_b = C \cdot V_m$$

V_b = Volume at base conditions
C = Conversion factor
V_m = Volume at measurement conditions

$$C = \frac{p}{p_b} \cdot \frac{T_b}{T} \cdot \frac{Z_b}{Z}$$

p = Gas pressure at measurement conditions
p_b = Pressure at base conditions
T = Gas temperature at measurement conditions
T_b = Temperature at base conditions
Z_b = Compression factor at base conditions
Z = Compression factor at measurement conditions

The measurement conditions are either determined with pressure and temperature transmitters or entered as fixed value.

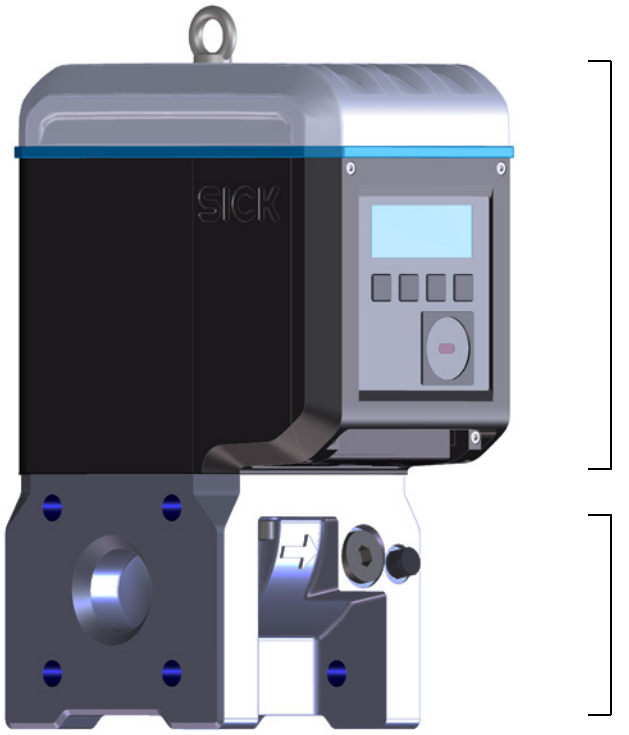
The following short forms are used in this document for better readability:
- Volume at base conditions = base volume
- Volume at measurement conditions = measurement volume

2.2 FLOWSIC500 measuring system

The FLOWSIC500 measuring system comprises:

- FLOWSIC500 gas flow meter,
- Adapter for installation in pipeline and
- optional p&T sensors for the volume conversion device option.

Fig. 4 FLOWSIC500 components



2.2.1 Adapter

The adapter is available in various flange standards and fitting lengths to connect the gas flow meter to the system pipeline.

Depending on the version, the adapter is designed for assembly on line flanges PN16 in accordance with DIN EN1092-1, CL150 in accordance with ASME B16.5, or 1.6MPa in accordance with GOST 12815-80.

Fitting lengths available: → p. 117, § 9.4.

2.2.2 Gas flow meter

An internal flow conditioner rectifies the gas flow in the gas flow meter so that flow profile disturbances caused by pipe bends in the inlet or outlet sections or components projecting into the pipe (e.g., a thermowell) have no influence on measuring results.

The gas flow meter can be replaced without taking the adapter out of the pipeline.

The gas flow meter is fitted with:

- Control unit
- Optical and electrical interfaces
- Measuring cell with ultrasonic transducers
- Electronics.

The product variant with volume conversion and integrated pressure and temperature transmitters also has the calibrated pressure transmitter and calibrated temperature transmitter fitted in the gas flow meter.

2.3 Meter sizes

Available meter sizes → p. 117, § 9.4.

2.4 Power supply

The FLOWSIC500 is available with two configurations:

- For operation with external intrinsically safe power supply with backup battery (backup duration: Approx. 3 months).
- Self-sufficient power configuration: 2 internal longlife battery packs (typical service life: At least 5 years).

  The second battery pack is activated automatically when the first pack is empty and a message displayed (→ p. 58, § 5.2).

2.5 Interfaces

The FLOWSIC500 supports various digital and serial interfaces.

The configuration of the interfaces as delivered is described in the delivery documents provided with the respective device.

Table 1 Interface configurations

	Config. 1 (LF)	Config. 2 (HF)	Config 3 (Encoder + LF)	Config. 4 (RS485)	Config. 5 (Encoder + HF)
	Type code I/O: F	Type code I/O: G	Type code I/O: H	Type code I/O: I or J	Type code I/O: K
DO_0	-	HF pulses	Encoder	-	Encoder
DO_1	Normal mode: Diagnosis warning, test mode: Test pulses				HF pulses
DO_2	LF pulses	-	-	-	-
DO_3	Malfunction	Malfunction	LF pulses	-	Malfunction
Serial	-		-	RS485	-

- Information on explosion-technical characteristics and rated voltage → p. 37, § 3.4.
- Details on standard interface configurations available → p. 42, § 3.4.6.

2.5.1 Pulse and status outputs

FLOWSIC500 has 4 digital switching outputs. Digital switching outputs DO_0, DO_2 and DO_3 are electrically isolated according to EN 60947-5-6.

Alternatively, digital switching outputs DO_2 and DO_3 can also be configured as Open Collector.

When used as pulse output, maximum 2 kHz can be output on digital switching output DO_0 and maximum 100 Hz on digital switching outputs DO_2 and DO_3. When used as status output, status information "Validity of measurement" or the result of the self-diagnosis can be represented.

Digital switching output DO_1 is not electrically isolated. In normal mode, the diagnosis warning is output on DO_1, test pulses are output in test mode.

The digital switching outputs are updated synchronously once per second.

2.5.2 Encoder totalizer

Alternatively, NAMUR switching output DO_0 can be configured so that the reading of totalizer Vm, the meter status and a meter identification are output via asynchronous serial communication. This allows the connection of volume convertors with a suitable input for encoder totalizers.

NOTICE:

If encoder communication has been configured, ensure that the transferred number of digits and the counter resolution can be processed by a connected volume converter.

When the parameter locking switch is open, a parameter change can be performed at the FLOWSIC500 using the FLOWgate500 operating software.

2.5.3 Serial data interface

The serial interface is designed as externally powered RS485 and requires an external intrinsically safe power supply for operation. The RS485 interface has no internal line termination.

2.5.4 Optical data interface

An optical interface according to IEC 62056-21 with serial bit, asynchronous data transmission is located on the front of the FLOWSIC500.

The interface can be used to read out data and parameter settings and to configure the FLOWSIC500.

2.6 Device option: Volume conversion

2.6.1 Volume conversion

The FLOWSIC500 gas flow meter with volume conversion captures the gas volume under measurement conditions and converts it to a volume under base conditions.

Gas volume conversion can run selectively (set at the factory) as PTZ or TZ volume conversion: The configuration as temperature volume conversion uses the default value for measurement pressure for calculations.

Measurement conditions are recorded with the pressure and temperature transmitters or entered as fixed values.

By default, measured values recording and subsequent conversion to the volume under base conditions are performed every 30 seconds. The update interval can be adjusted → p. 69, § 5.2.6.5, “Calculation”.

Depending on the configuration, the compressibility factor (K-factor) is determined with one of the following calculation methods or can be entered as a fixed value.

- SGERG88,
- AGA 8 Gross method 1
- AGA 8 Gross method 2
- AGA NX-19
- AGA NX-19 mod.
- Fixed value

The FLOWSIC500 checks the permissible entry limits of the parameters for the selected calculation method. If one of the entry values is outside the limit values, the FLOWSIC500 switches to malfunction state and uses the fixed value of the compressibility factor for calculation of the basis volume.

An absolute pressure transmitter EDT 23 (optional: relative pressure transmitter EDT 23) and a temperature transmitter EDT 34 measure current measurement conditions and transfer the transmitter type, measured value as well as the transmitter status via a digital interface.

The FLOWSIC500 reads the valid measuring range automatically and, periodically, the current status and measured value.

A transmitter is only activated for measurement when the configured serial number matches the serial number transferred for the transmitter.

If no transmitter is detected or a transmitter is not functioning correctly, the

FLOWSIC500 automatically uses the stored default value (= fixed value) of the state variable.

In this case, the FLOWSIC500 switches to malfunction state and, using the default value, stores the volume under base conditions calculated for pressure or temperature in the error volume counter.

If not specified otherwise, the FLOWSIC500 is supplied with the following standard settings:

Table 2 Standard settings

Unit system	SI	Imperial
T unit	°C	° F
P unit	bar	psi
Symbols according to	EN 12405	API
Calculation method	SGERG88	AGA 8 Gross method 1
Reference conditions for density and heating value	(T1/T2/p2) 25 °C/0 °C/1.01325 bar (a)	(T1/T2/p2) 60 °F/60 °F/14.7300 psi (a)
Base pressure	1.01325 bar (a)	14.7300 psi (a)
Base temperature	0 °C	60 °F

2.6.2 Integrated pressure and temperature transmitters

The FLOWSIC500 with volume conversion and integrated pressure and temperature transmitters does not have any external components. The internal pressure and temperature transmitters are already fitted and calibrated at the factory. The measuring ports are located in the gas flow meter.

This means the FLOWSIC500 does not require any additional installation of transmitters to determine the measurement conditions and is immediately ready for operation after volume conversion has been configured.

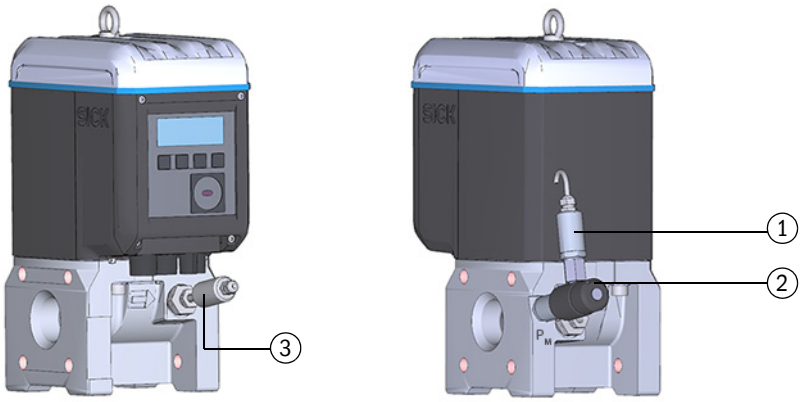
2.6.3 External pressure and temperature transmitters

The FLOWSIC500 with volume conversion and external transmitters is used at measuring ports where a test/calibration of the pressure or temperature transmitter in the system may be required.

It is recommended to install a three-way test valve that separates the pressure transmitter from the measurement pressure and provides a test connection to test the pressure transmitter.

→ Fig. 5 shows a FLOWSIC500 with external transmitters and Kamstrup test valve BDA04 for gas temperatures to -25 °C.

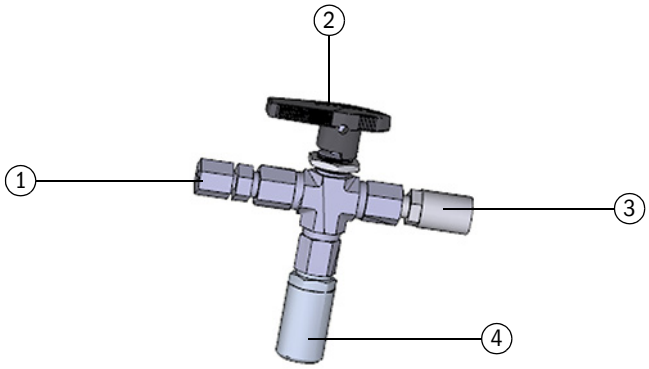
Fig. 5 FLOWSIC500 with external transmitters and Kamstrup test valve BDA04



1 Pressure transmitter
2 Kamstrup test valve BDA04
3 Temperature transmitter

A three-way test valve (→ Fig. 6) that is fitted next to the FLOWSIC500 is used for gas temperatures to -40 °C.

Fig. 6 Three-way test valve with p transmitter and Minimess coupling



1 FLOWSIC500 connection
2 Three-way test valve
3 Test connection (Minimess coupling)
4 Pressure transmitter

2.7 Totalizers

2.7.1 Device status and totalizers used

Various volume totalizers are fitted on the FLOWSIC500 depending on the configuration.

Meter V is used in the configuration as gas flow meter. If the gas flow meter has a malfunction, the measured volume is also recorded in the error volume counter errV.

Table 3 Device status and totalizers used

Status	Totalizer	
	V	errV
Operation	●	
Malfunction	●	●

A gas flow meter Vm, a base volume meter Vb and a total volume meter Vbtot are used in the configuration as gas flow meter with integrated volume conversion (device option). If malfunctions occur, the measured values are not recorded in the base volume meter Vb, but the converted volume is recorded in the error volume meter errVb.

Table 4 Device status and totalizers used (with device option volume conversion)

Status	Totalizer				
	Vb	errVb	Vbtot	Vm	errVm
Operation	●		●	●	
Malfunction		●	●	●	●

Authorized users (user level "Authorized user") can reset the error volume counters → p. 73, § 5.2.11.

2.7.2 Reverse flow

The FLOWSIC500 is designed as unidirectional type and has a configurable zero-flow cutoff which is factory set to a value of 1 m^3 (35 ft^3) as default.

The totalizers are stopped during reverse flow and this volume is counted in a separate buffer totalizer. When normal operation resumes, the buffer totalizer is first computed with the flow.

The totalizers are first incremented again after the reverse flow volume has passed through.

During reverse flow, the meter first switches to malfunction when the preconfigured buffer volume has been exceeded. An error message is output on the device.

2.8 Logbooks and Archives

The integrated data registration stores meter readings, maximums and other data in the following archives:

- Measuring period archive

  Totalizers and data saved after the measuring period elapses (standard = 60 min.). The measuring period can be adjusted → p. 71, § 5.2.6.9.
- Daily archive

  Totalizers and data saved at the defined gas hour time (standard = 06:00)
- Monthly archive

  Totalizers and data saved at the defined gas day time (standard = 1st day of month)

Explanations on data structure and storage depth are available in Technical Bulletin "Data Registration").

The FLOWSIC500 stores events and parameter changes in the following logbooks:

- Event logbook

  All events with timestamp, user logged on and totalizer reading, max. number of entries: 1000

  When the Event logbook is 90% full, the FLOWSIC500 changes to device status "Warning", warning W-2001 is shown on the display.

  When the Event logbook is full, the FLOWSIC500 changes to device status "Malfunction", error E-3001 is shown on the display (→ p. 78, § 6.2, “Status messages”).
- Parameter logbook

  All parameter changes with timestamp, user logged on, totalizer reading and old and new parameter value, max. number of entries: 250

  The oldest entries are overwritten when the Parameter logbook is full.
- Metrology logbook

  All changes to selected calibration-relevant parameters (→ p. 24, § 2.9.2), with parameter locking switch activated with timestamp, user logged on, totalizer reading and old and new parameter value, max. number of entries: 100

  When the Metrology logbook is full, calibration-relevant parameters can be modified only after the parameter locking switch has been opened. The FLOWSIC500 changes to device status "Warning", warning W-2002 is shown on the display (→ p. 78, § 6.2, “Status messages”).

The data are stored in non-volatile memory. All logbooks can be viewed, stored and reset with operating software FLOWgate500. The Event logbook can be viewed after logon as "User" or "Authorized user" on the device.

The following parameters are displayed:

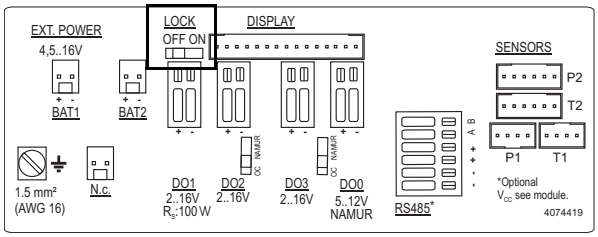
- Event type
- Number of events
- Short description
- Timestamp

2.9 Parameter protection

2.9.1 Parameter locking switch

A parameter locking switch is located on the circuit board to secure the calibration-relevant parameters. This covers all values that influence volume metering and volume conversion.

Fig. 7 Parameter locking switch on the circuit board



The parameter locking switch is secured by the terminal compartment cover and a seal.

2.9.2 Metrology logbook

Selected calibration-relevant parameters can be modified when the parameter locking switch is closed and after logging in as authorized user.

To ensure traceability of these parameter changes, an entry is created in the Metrology logbook. This entry contains the timestamp, old and new value of the parameter changed, meter reading V (for gas flow meters) or Vb (for gas flow meters with device option volume conversion) and the logged on user.

The Metrology logbook can have a maximum of 100 entries. The FLOWSIC500 switches to status "Warning" when the Metrology logbook is full.

The Metrology logbook can be cleared when the parameter locking switch is open. Parameter changes to the following parameters are entered in the Metrology logbook as long as entries are possible

Table 5 Calibration-relevant parameters - gas flow meter

Parameter	Description
Reverse flow limit	Buffer volume for reverse flow
Symbols for measured value displays	Symbols used on the display (formula symbols)

Table 6 Calibration-relevant parameters - gas flow meter with volume conversion

Parameter	Description
Reverse flow limit	Buffer volume for reverse flow
Symbols for measured value displays	Symbols used on the display (formula symbols)
Flow - lower warning limit	Lower warning limit for the flow which can be set by the customer
Flow - upper warning limit	Upper warning limit for the flow which can be set by the customer
Calculation method	Calculation method for the compressibility factor
Calculation interval	Cycle time for updating measured values (pressure, temperature) and calculation of the compressibility factor
Standard pressure	Standard pressure
Standard temperature	Standard temperature
Reference conditions	Reference conditions for density and heating value
Atmospheric pressure	Ambient pressure
K-factor (fixed)	Figure for method "Fixed value" when the calculation of the K-factor is incorrect.
CO2	CO_2 proportion in gas
H2	H_2 proportion in gas
N2	N_2 proportion in gas
Relative density	Relation between gas density and air density under reference conditions
Reference density	Gas reference density under reference conditions
Heating value	Gas heating (under reference conditions)
Heating value unit	Heating value unit
p Default value	Fixed value of measurement pressure
p Unit	Unit for pressure values, used for entry and display
p Lower alarm limit	Lower warning limit for the pressure which can be set by the customer
p Upper alarm limit	Upper warning limit for the pressure which can be set by the customer
p Unit	Unit for pressure values
T Default value	Fixed value of measurement temperature
T Unit	Unit for temperature values, used for entry and display
T Lower alarm limit	Lower warning limit for the temperature which can be set by the customer
T Upper alarm limit	Upper warning limit for the temperature which can be set by the customer
T Unit	Unit for temperature values, used for entry and display
Gas hour	Billing hour for the day archive
Gas day	Billing day for month archive
Measuring period	Period for billing archive

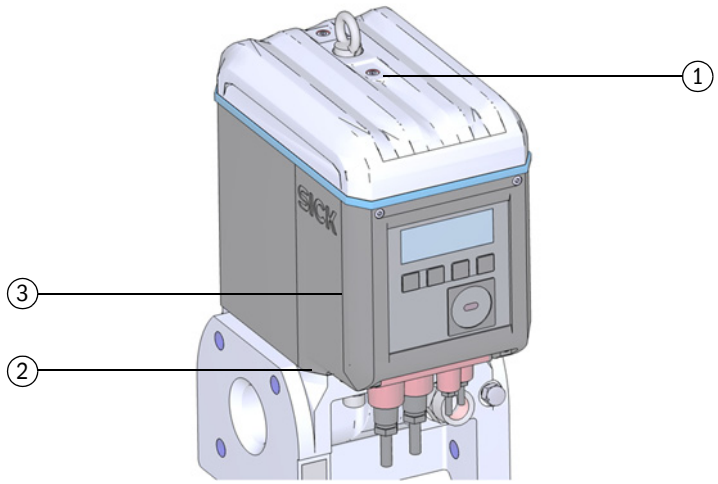
2.10 Sealing

The FLOWSIC500 is secured at the factory with a seal on the cover.

Gas flow meter and adapter can be secured at the joint by a user seal (adhesive label) glued with approximately equal spread on gas flow meter and adapter.

Optionally, the electronics cover can also be protected by the customer after the end of the installation against unauthorized opening.

Fig. 8 Factory seal of the cover on the gas flow meter



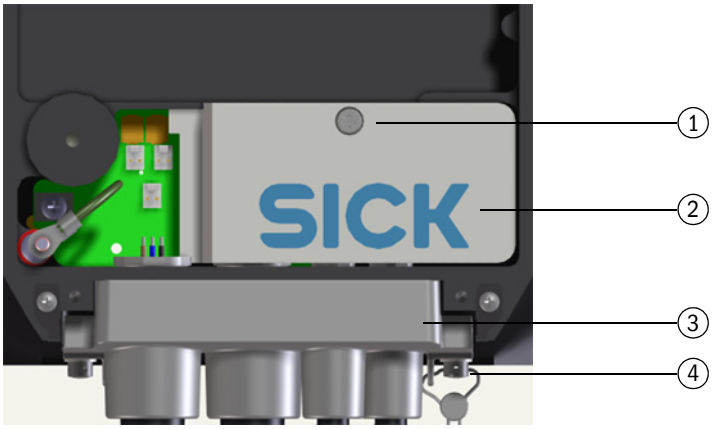
1 Seal position
2 Possible position of the adapter seal
3 Possible position of the electronic cover seal

In addition, the FLOWSIC500 has seal positions on the terminal compartment cover and the plug-in connector cover.

An adhesive label secures the interfaces and the parameter locking switch by the terminal cover compartment.

During the start-up, the plug-in connector cover must be secured according to national regulations. This can be performed with an adhesive label which is glued with approximately equal spread on the cover and the enclosure or alternatively by using capstan screws and a tensioned sealing wire and a wire seal.

Fig. 9 Seals on the terminal compartment and plug-in connector cover

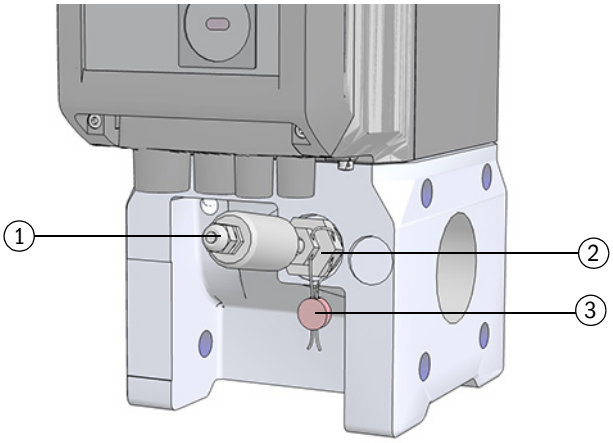


1 Seal position
2 Terminal compartment cover (securing the terminal compartment)
3 Plug-in connector cover
4 Capstan screw, wire and wire seal (securing of plug-in connector cover)

NOTICE:

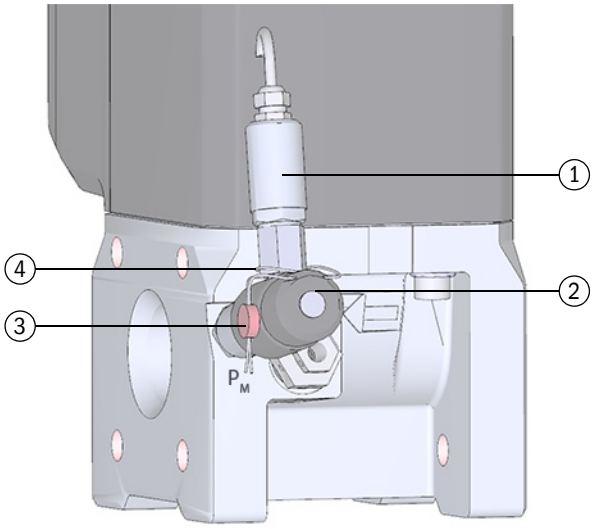
► Secure the terminal compartment cover and the plug-in connector cover with at least one verification seal against unauthorized removal of the cover!

Fig. 10 Seal on the temperature transmitter (example)



1 Temperature transmitter
2 Locknut
3 Wire seal

Fig. 11 Seal on the pressure transmitter (example)



1 Pressure transmitter
2 Kamstrup test valve BDA04
3 Wire seal
4 Wire loop

NOTICE:
Make sure that the wire loop is placed tight around the pressure transmitter.

FLOWSIC500

3 Installation

Hazards during installation
General information
Mechanical installation
Electrical installation
External pressure and temperature transmitters installation

3.1 Hazards during installation

CAUTION: General risks during installation

- ► Observe applicable valid regulations, general standards and guidelines.
- ► Observe local safety regulations, operating instructions and special regulations.
- ► Observe the safety information in → p. 10, § 1.1.
- ► Comply with the safety requirements of Pressure Equipment Directive 97/23/EC or ASME B31.3 when installing pressure devices including connection of various pressure devices.
- ► Persons carrying out installation work must be familiar with the directives and standards applicable for pipeline construction and have the corresponding qualifications, e.g. in accordance with DIN EN 1591-4.

WARNING: Hazards through the gas in the system

The following conditions can increase the risk:

- Toxic gas or gas dangerous to health
- Explosive gas
- High gas pressure

- ► Only carry out installation, pre and repair work when the system is non-pressurized.

WARNING: Hazards during installation work

- ► Do not carry out any welding work on lines with meters fitted.
- ► Comply exactly with mandatory and approved methods.
- ► Observe and comply with regulations of the plant operator.
- ► Meticulously check completed work. Ensure leak tightness and strength.

Otherwise hazards are possible and safe operation is not ensured.

3.2 General information

3.2.1 Delivery

The FLOWSIC500 is delivered preassembled in sturdy packaging.

- ► Inspect for transport damage when unpacking the device.
- ► Document any damage found and report this to the manufacturer.

NOTICE:
Do not put the FLOWSIC500 into operation if you notice any damage!

- ► Check the scope of delivery for completeness.

The standard scope of delivery comprises:

- FLOWSIC500 (gas flow meter and adapter, already fitted),
- Backup battery (if device is configured for external power supply), or
- 2 battery packs (if device is configured for battery operation).

3.2.2 Transport

► During all transport and storage work, ensure:
- The FLOWSIC500 is always well secured
- Measures to prevent mechanical damage have been taken
- Ambient conditions are within specified limits.

3.3 Mechanical installation

CAUTION: General risks during installation
- ► Observe applicable valid regulations, general standards and guidelines.
- ► Observe local safety regulations, operating instructions and special regulations.
- ► Observe the safety information in → p. 10, § 1.1.
- ► Comply with the safety requirements of Pressure Equipment Directive 97/23/EC or ASME B31.3 when installing pressure devices including connection of various pressure devices.
- ► Persons carrying out installation work must be familiar with the directives and standards applicable for pipeline construction and have the corresponding qualifications, e.g. in accordance with DIN EN 1591-4.

The FLOWSIC500 normally does not need straight inlet and outlet sections and can be fitted directly after bends in the pipe.

***NOTICE:* Requirements on installation**
- ► At a distance up to 5 DN upstream to the adapter, the following elements must not occur:
  - a valve which is not always fully open during operation,
  - a pressure regulator.
- ► The temperature sensor must not be disposed more than 5 DN downstream of the gas meter. The temperature sensor can be inserted in the optional thermowells at the adapter alternatively.
- ► In concrete application, observe limitations resulting from type approval!

3.3.1 Preparations

► Select a suitable mounting location. Ensure adequate mounting clearances (→ Table 9).

► The following tools and materials are required to install the FLOWSIC500:
- Hoisting equipment (lifting capacity according to the weight specifications → p. 117, § 9.4)
- Box wrench with size suitable for flange installation
- Torque wrench
- Flange gaskets
- Anti-seize paste, metal-free or suitable for aluminium, e.g. OKS 235, to prevent thread mountings seizing up

  NOTICE:
  Do not use copper paste!

- 3 mm Allen key
- Leak detection.

3.3.2 Choosing flanges, gaskets and other components

For flange connections only use pipeline flanges, bolts, nuts and gaskets suitable for the maximum operating pressure, maximum operating temperature as well as ambient and operating conditions (external and internal corrosion).

→ Table 7 contains a list of recommended bolts and → Table 8 contains a list of recommended gaskets.

Table 7 Bolts and tightening torques

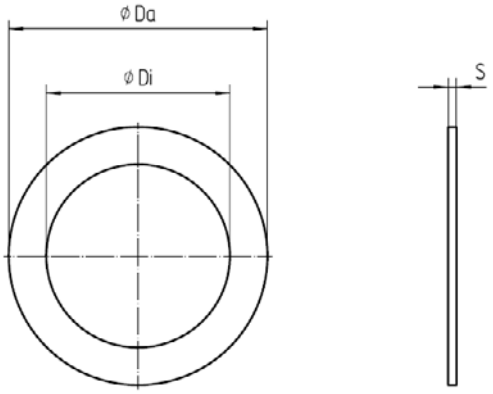
Device/flange type	Bolts	Washers	Nuts	Tightening torque	
DN50/ PN16	4 pc. DIN835-M16x45-A2-70	4 pc. DIN125-A17-A2	4 pc. ISO4032-M16-A2-70	130 Nm	96 lbf ft
DN80/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A17-A2	8 pc. ISO4032-M16-A2-70	130 Nm	96 lbf ft
DN100/ PN16					
DN150/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A21-A2	4 pc. ISO4032-M20-A2-70	250 Nm	184 lbf ft
2"/ Cl150	4 pc. Double end threaded stud Ø 5/8", length 3.5- ASME B18.31.2, ASTM A193 Grade B8M	4 pc. Type A plain washer (narrow series) Ø 5/8" - ANSI B18.22.1, grade 8 stainless steel	4 pc. Hex flat nut (UNC series) Ø 5/8" - ANSI B18.2.2, ASTM A194 Grade 8MA	140 Nm	103 lbf ft
3"/ Cl150					
4"/ Cl150	8 pc. Double end threaded stud Ø 5/8", length 3.5- ASME B18.31.2, ASTM A193 Grade B8M	8 pc. Type A plain washer (narrow series) Ø 5/8" - ANSI B18.22.1, grade 8 stainless steel	8 pc. Hex flat nut (UNC series) Ø 5/8" - ANSI B18.2.2, ASTM A194 Grade 8MA	140 Nm	103 lbf ft
6"/ Cl150	8 pc. Double end threaded stud Ø 3/4", length 4- ASME B18.31.2, ASTM A193 Grade B8M	8 pc. Type A plain washer (narrow series) Ø 3/4" - ANSI B18.22.1, grade 8 stainless steel	8 pc. Hex flat nut (UNC series) Ø 3/4" - ANSI B18.2.2, ASTM A194 Grade 8MA	240 Nm	177 lbf ft

Table 8 Gaskets

Device/flange type	Da[1] [mm]	Di [mm]	S [mm]	Material
DN50/ PN16	102	61	2	novapress® FLEXIBLE/815
DN80/ PN16	138	89		
DN100/ PN16	158	115		
DN150/ PN16	212	169		
2"/ Cl150	92	60	2	novapress® FLEXIBLE/815
3"/ Cl150	127	89		
4"/ Cl150	157	114		
6"/ Cl150	216	168		

[1] Da = outer diameter, Di = inner diameter, S = thickness, → Fig. 12

Fig. 12 Dimensions of gaskets



3.3.3 Fitting the FLOWSIC500 in the pipeline

NOTICE:
The lifting lug is designed for transporting the measuring device only.
Do not lift or transport the FLOWSIC500 with additional loads using this lug.

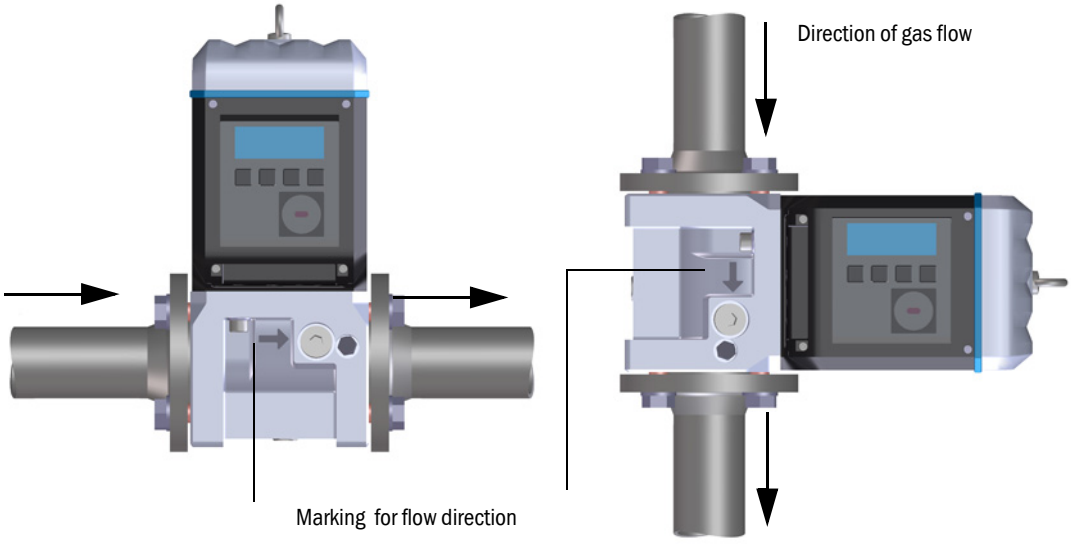
- ► The FLOWSIC500 must not swing or tilt on the hoisting equipment during transport.
- ► The FLOWSIC500 must not turn during transport otherwise the lifting lug could be screwed out.

NOTICE: **Observe the gas flow direction**
The prescribed flow direction is marked on the adapter with an arrow.
Arrow direction and gas flow direction must match.

- ► Install the FLOWSIC500 in flow direction.
  The device signals a malfunction when the FLOWSIC500 is installed against the prescribed flow direction.

The FLOWSIC500 can be installed horizontal or vertical.
The control unit can be rotated ± 90° (→ p. 40, §3.4.4).

Fig. 13 Installation examples



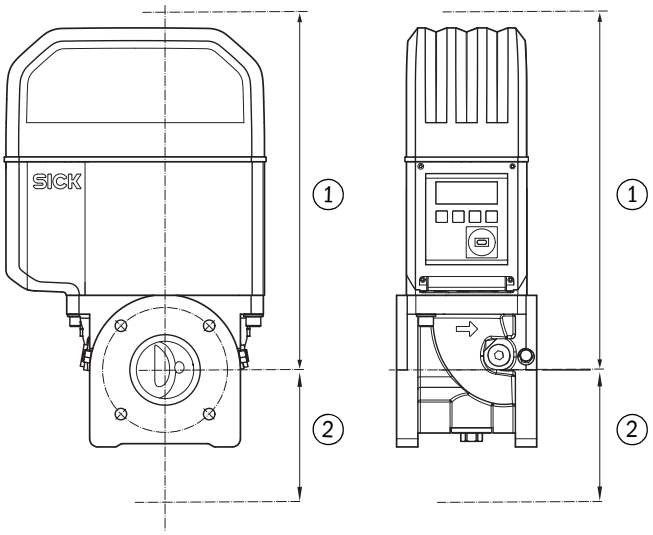
3.3.3.1 **Mounting clearances**

Adequate mounting clearances must be maintained to ensure that sufficient space is available for exchanging the gas flow meter.

The clearance at the top is required for removing the gas flow meter and placing it back on the adapter. The clearance at the bottom is required for loosening and removing or re-inserting the screws and applying the tool accordingly.

> ***NOTICE:***
> Depending on the tools used and the mounting location, sufficient clearances to the left and right must be ensured.

Fig. 14 Mounting clearances



1 Clearance at the top
2 Clearance at the bottom

Table 9 Required minimum clearance based on the pipe axis

Meter size	Clearance at the top, without lifting lug		Clearance at the top, with lifting lug		Clearance at the bottom	
	[mm]	[in]	[mm]	[in]	[mm]	[in]
DN50/2"	300	11.81	340	13.39	200	7.87
DN80/3"	460	18.11	510	20.08	250	9.84
DN100/4"	520	20.47	570	22.44	320	12.6
DN100/6"	520	20.47	570	22.44	320	12.6

3.3.3.2 Torque on the pipeline

NOTICE:
If the FLOWSIC500 is installed so that the gas flow meter projects sideways from the pipeline, the gas flow meter weight creates a torque on the pipeline.

► Make sure the pipeline is capable of holding the gas flow meter → p. 36, Table 10.

Table 10 Pipeline torque

Meter size	Torque	
	[Nm]	[lbf ft]
DN50/2"	6	5
DN80/3"	16	12
DN100/4"	31	23
DN150/6"	31	23

3.3.3.3 Installation in pipeline

1 Select suitable bolts.
Recommended bolts → Table 7.
2 Use the hoisting equipment to position the FLOWSIC500 in the desired location in the pipeline.
Lay the pipelines without tension to the device to be installed!
3 Insert and align the gaskets.
4 Apply anti-seize paste to the bolts.
5 First screw the bolts by hand into the adapter to the stop.
– Screw in the bolts according to DIN835 with the shorter thread end.
– The bolts according to ASME B18.31.2 can be screwed in with any end.
6 Check the thread length in the adapter is fully utilized.
7 Then install the washers and nuts, and tighten them by hand.
8 Check whether the thread length of the nut is fully utilized.
If necessary, use a different bolt length.
9 Check correct positioning of flange gaskets.
10 Tighten nuts evenly and crosswise in small steps until the specified tightening torque is reached (→ Table 7).
Make sure the flange sits free of tension.
11 Slowly increase the pressure in the pipeline.
Gradient: Max. 3bar/min (45psi/min)
12 Carry out a leak tightness check on the pipeline (in accordance with the pipeline manufacturer's specifications).

3.4 Electrical installation

3.4.1 Requirements for use in potentially explosive atmospheres

The FLOWSIC500 is suitable for use in potentially explosive atmospheres:
ATEX: II 2G Ex ia [ia] IIB T4 Gb, II 2G Ex ia [ia] IIC T4 Gb, II 2G Ex op is IIC T4 Gb
IECEx: Ex ia [ia] IIB T4 Gb, Ex ia [ia] IIC T4 Gb, Ex op is IIC T4 Gb
US/C: Class I Division 1, Groups C, D T4, Ex/AEx ia IIB T4 Ga

For a FLOWSIC500 used in potentially explosive atmospheres:

- ► Installation, start-up, maintenance and inspection may only be carried out by skilled persons having knowledge of the relevant rules and regulations for potentially explosive atmospheres, especially:
  - Ignition protection types
  - Installation regulations
  - Category classification
- ► Comply with all valid IEC standards.

The FLOWSIC500 is suitable for measuring combustible and occasionally ignitable gases corresponding to zones 1 and 2.

Basic requirements

- ► The documentation for zone categorization in accordance with IEC60079-10 must be available
- ► The FLOWSIC500 must have been checked for suitability for the actual installation location and the Ex marking on the device must match the requirements.
- ► After installation and before initial start-up, the complete equipment and the system must be inspected in compliance with IEC 60079-17.

WARNING: Risk of explosion

All electrical connections of the FLOWSIC500 are approved for connection to the certified intrinsically safe power circuits only.

- ► Proof of the intrinsic safety in compliance with IEC 60079-14 must be presented for interconnection with the associated intrinsically safe equipment.

  Otherwise the intrinsic safety of the FLOWSIC500 can be endangered, i.e. the ignition protection for the FLOWSIC500 can no longer be ensured.

Operating conditions for the ultrasonic sensors

The FLOWSIC500 is designed for use in potentially explosive atmospheres solely under normal atmospheric conditions within the following limits.

- Ambient pressure range 0.8 bar (11.6 psi) to 1.1 bar (15.95 psi)
- Air with normal oxygen content, normally 21 percent by volume

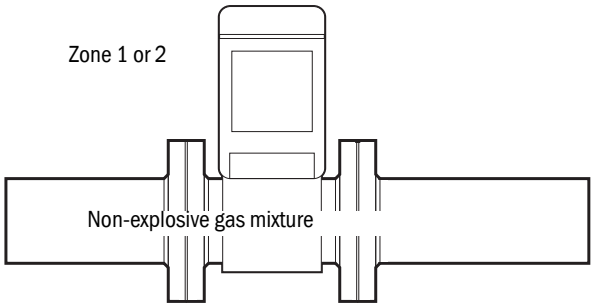
The ambient temperature must be within the range specified on the type plate.

The gas flow meter becomes part of the pipeline as soon as the FLOWSIC500 is installed in the pipeline.

The walls of the pipeline and the gas flow meter then serve as zone-separating barrier. The following Figure shows the different situations for a possible application and the operating conditions that apply.

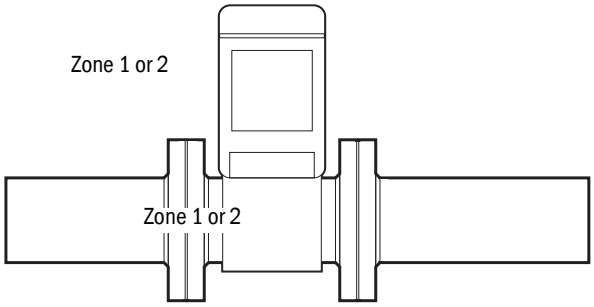
Fig. 15 Ex zones

Case 1:



- The pipeline contains a non-explosive mixture. The gas mixture can be combustible.
- Gas pressure and gas temperature can be within the range specified on the type plate of the gas flow meter.

Case 2:



- The area inside the pipeline is classified as potentially explosive atmosphere Zone 1 or 2.
- The gas pressure must be within the range 0.8 (11.6 psi) to 1.1 bar (15.95 psi) (normal atmospheric conditions).
- Gas temperature must be within the permitted ambient temperature range specified by the type plate on the gas flow meter

WARNING: Risk of ignition due to impact on the ultrasonic transducers

The ultrasonic transducers are manufactured from titanium. The pipeline adaptor and part of the electronic enclosure may be made from aluminium. In rare cases, ignition sources due to impact and friction sparks could occur.

The maximum piezo-electric energy released by impact on the ultrasonic transducers exceeds the limit for Gas Group IIC specified in Clause 10.7 of EN60079-11:2012.

- ► For this reason, the ultrasonic transducers may only be used in zone 1 when risks of ignition arising from impacts or friction on the sensor housing can be ruled out within the application.
- ► Only ultrasonic transducers provided by SICK may be used!

3.4.2 Criteria for electrical connection

Installation work → p. 31, §3.3 must be completed.

WARNING: Risk of explosion - hazard for intrinsic safety

► The following work may only be carried out by skilled technicians familiar with the special characteristics of the intrinsic safety of the ignition protection type and who have knowledge of the relevant standards and regulations for interconnection of intrinsically safe power circuits.

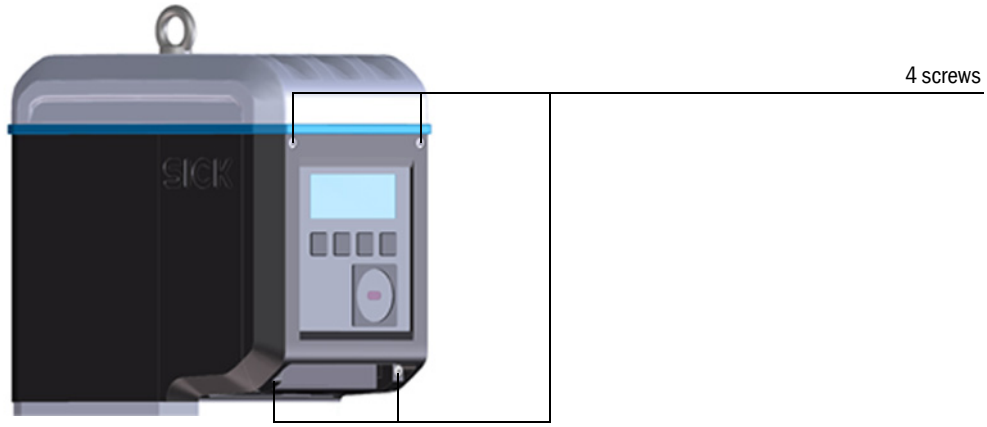
3.4.3 Opening and closing the electronics cover

The Ex i terminal compartment of the FLOWSIC500 can be accessed after the electronics cover has been opened. The cover may also be opened in the hazardous area when under voltage. However, safe separation between the various intrinsically safe power circuits must not be breached.

Opening the electronics cover

1 Loosen the 4 screws (captive) on the electronics cover using a 3 mm Allen key.

Fig. 16 Position of electronics cover screws



2 Open the electronics cover.

Closing the electronic cover

1 Close the electronics cover.

► Make sure no battery and display cables are pinched.

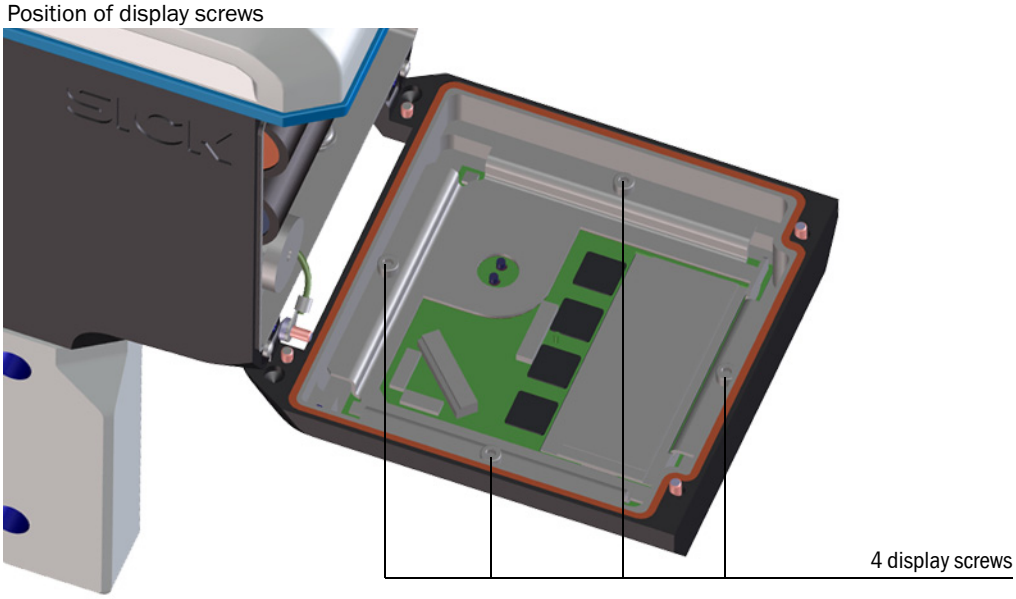
2 Screw the electronics cover tight again.
Tightening torque: 2.0 Nm (18 lbf in)

3.4.4 Rotating the control unit

1 Open the electronics cover (→ p. 37, § 3.4)

2 Loosen the 4 display screws with a 3 mm Allen key, → Fig. 17.

Fig. 17 Position of display screws



3 Rotate the display in the desired direction.

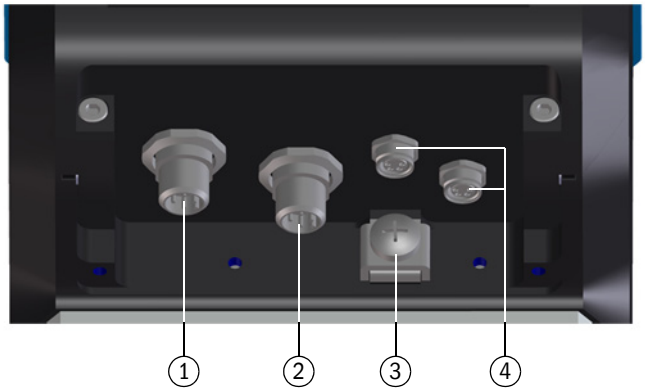
4 Tighten the display screws evenly.
Tightening torque: 1.0 Nm (9 lbf in)

5 Close the electronics cover again.

3.4.5 Electrical connections

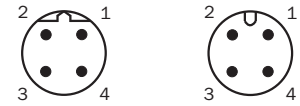
The FLOWSIC500 interfaces are accessible from the outside via external plug-in connectors.

Fig. 18 Connections



1 Plug-in connector 1 (B-coded): External power supply and signal output
2 Plug-in connector 2 (A-coded): Signal output
3 Ground screw
4 Connections for pressure/temperature transmitters (optional)

Fig. 19 M12 plug-in connector coding



Plug-in connector 1 (B-coded)

Plug-in connector 2 (A-coded)

NOTICE:
Safety relevant parameters are valid for connecting all pins of a plug-in connector.

Plug-in connector 2 (A-coded) can be configured when ordered, configuration options → p. 42, § 3.4.6.
The respective configuration is printed on the type plate (→ p. 43).

The external power supply need not be connected when the FLOWSIC500 is operated with internal batteries.

3.4.6 Pin assignment of plug-in connectors

3.4.6.1 Plug-in connector 1: External power supply and signal output

Table 11 Pin assignment for M12 plug-in connector 1 (male/B-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
1	PWR-	Voltage supply	Rated input voltage 4.5 ... 16 V	U_i = 20 V I_i = 667 mA P_i = 753 mW U_o = 8.2 V I_o = 0.83 mA P_o = 1.7 mW C_o = 7,6 µF L_o = 100 mH
2	PWR+			
3	DO_1-	Diagnosis warning, pulse output in test mode (→ Table 1) and in configuration K, f_{max} = 2 kHz at 120 % Q_{max}	Passive, not electrically isolated Max. 16 V Max. 100 mA R_{on} < 110 Ω R_{off} > 1 MΩ	
4	DO_1+			

3.4.6.2 Plug-in connector 2: Signal output

Table 12 Pin assignment for M12 plug-in connector 2 (male/A-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
Pin assignment configuration 1 LF pulses and malfunction (electrically isolated), Type code I/O: F				
1	DO_2+	LF pulses f_{max} configurable up to 100 Hz at 120 % Q_{max}	Passive, electrically isolated, configurable as: OC (Open Collector)*: Max. 16 V Rated current 20 mA or NAMUR: Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	U_i = 20 V P_i = 753 mW
2	DO_2-			
3	DO_3-	Malfunction		
4	DO_3+			
Pin assignment configuration 2 : HF pulses and malfunction (electrically isolated), Type code I/O: G				
1	DO_0+	HF pulses f_{max} configurable up to 2 kHz at 120 % Q_{max}	NAMUR, electrically isolated, optically isolated Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	U_i = 20 V P_i = 753 mW
2	DO_0-			
3	DO_3-	Malfunction	Passive, electrically isolated, configurable as OC (Open Collector)* or NAMUR, see Configuration 1 for operating parameters	
4	DO_3+			
Pin assignment configuration 3 : Encoder and LF pulses (electrically isolated), Type code I/O: H				
1	DO_0+	Encoder protocol	NAMUR, electrically isolated, optically isolated Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	U_i = 20 V P_i = 753 mW
2	DO_0-			
3	DO_3-	LF pulses	Passive, electrically isolated, configurable as OC (Open Collector)* or NAMUR, see Configuration 1 for operating parameters	
4	DO_3+			

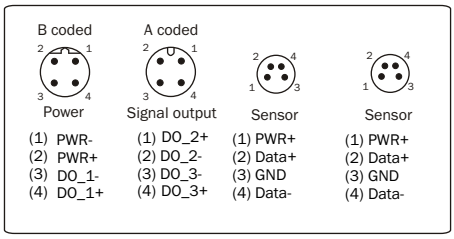
* Standard configuration

Table 12 Pin assignment for M12 plug-in connector 2 (male/A-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
Pin assignment configuration 4: RS485 module (externally powered), Standard Version: Type code I/O: J, Low voltage version: Type code I/O: I				
1	PWR+	RS485 module (externally powered)	Electrically isolated Standard version: Rated input voltage 4 ... 16 V Low voltage version: Rated input voltage 2.7 ... 10 V	U_i = 20 V P_i = 1.1 W IIC: C_i = 0.22 µF IIB: C_i = 1.35 µF L_i = 0.03 mH
2	Data A			
3	PWR-			
4	Data B			
Pin assignment configuration 5 : Encoder and HF pulses (not electrically isolated), Type code I/O: K				
The HF pulses are output via plug-in connector 1 (DO_1), → Table 11.				
1	DO_0+	Encoder protocol	NAMUR, electrically isolated, optically isolated Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	U_i = 20 V P_i = 753 mW
2	DO_0-			
3	DO_3-	Malfunction	Passive, electrically isolated, configurable as OC (Open Collector)* or NAMUR, see Configuration 1 for operating parameters	
4	DO_3+			

* Standard configuration

Fig. 20 Identification on the electronics type plate (example)



Internal terminal assignment→ p. 118, §9.5

3.4.7 Cable specifications

When the plugs available from SICK are used, a shielded control cable with 4x0.25 mm² cross-section, with PVC insulation and approx. 5 mm outer diameter is required.

WARNING: Requirements on cables and installation

- Pay attention to the requirements in EN 60079-14 when selecting the cables and during installation!
- Further legal requirements must be observed for use in explosive atmospheres.

SICK recommends the ready-made cables available as accessories (→ p. 104, §8.1).

3.4.8 Operation with external power supply

EX

The FLOWSIC500 is designed electrically intrinsically safe.

► After correct installation has been checked, the plug connections in the hazardous area can be connected and disconnected under voltage as well.

3.4.8.1 Connecting the external power supply

1 Connect the external intrinsically safe power supply to the M12 plug-in connector of the FLOWSIC500.
Safety-relevant parameters → p. 42, §3.4.6.

Fig. 21 Connection for external power supply underneath the gas flow meter

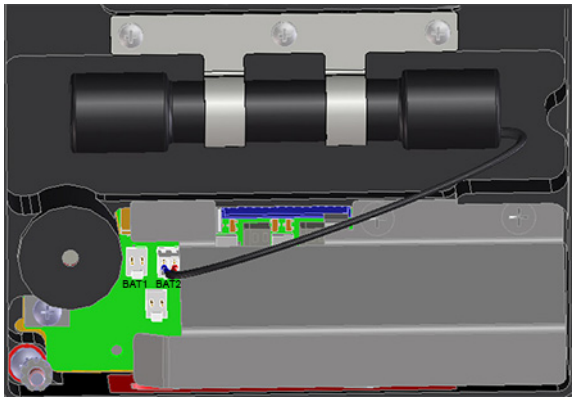
1 External power supply and signal output

2 Switch the power supply on.
The FLOWSIC500 is initialized.
3 Measurement starts and the current measured value for the gas volume appears.
4 Set the date and time (→ p. 54, §4.1).

3.4.8.2 Connecting the backup battery

1 Open the electronics cover (→ p. 39, 3.4.3).
2 Connect the back-up battery (part No. 2065928) to connection BAT2 in the terminal compartment (→ Fig. 22).
3 Close the electronics cover again.

Fig. 22 Connected back-up batteries



3.4.9 Operation with batteries

WARNING: Risk of of ignition due to electrostatic charge

Make sure to minimize electrostatic risks when handling the plastic portable battery packs.

- When a static-generating mechanism is identified, such as repeated brushing against clothing, take suitable precautions, e.g.the use of anti-static footwear.
- Activities such as placing the item in a pocket or on a belt, operating a keypad or cleaning with a damp cloth, do not present a significant electrostatic risk.

The FLOWSIC500 and the delivered battery packs are designed intrinsically safe.

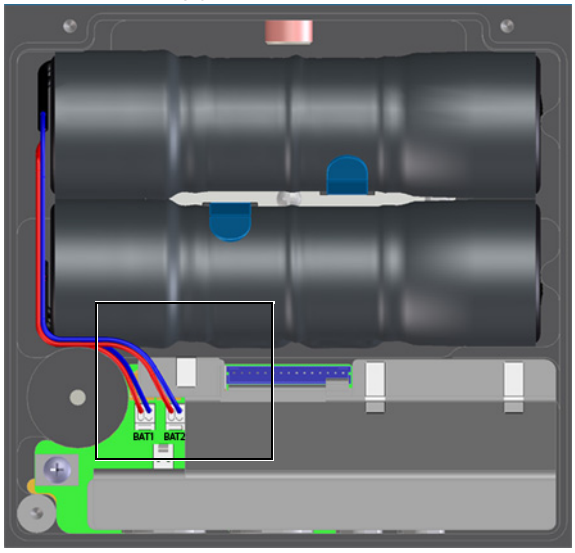
- Only the exchangeable battery packs from SICK with part no. 2064018 and the backup battery with part no. 2065928 may be used.
- The battery packs can be connected and disconnected in the hazardous area as well.
- Only connect the battery packs to the connections marked for this purpose in the terminal compartment of the FLOWSIC500.
- Modifying the electrical connection parts is not allowed.

1 Open the electronics cover (→ p. 39, 3.4.3)

2 Insert the battery packs as shown and connect to connections BAT1 and BAT2 in the terminal compartment.

The FLOWSIC500 is initialized.

Fig. 23 Connected battery packs



3 Close the electronics cover again.

4 Set the date and time (→ p. 54, §4.1).

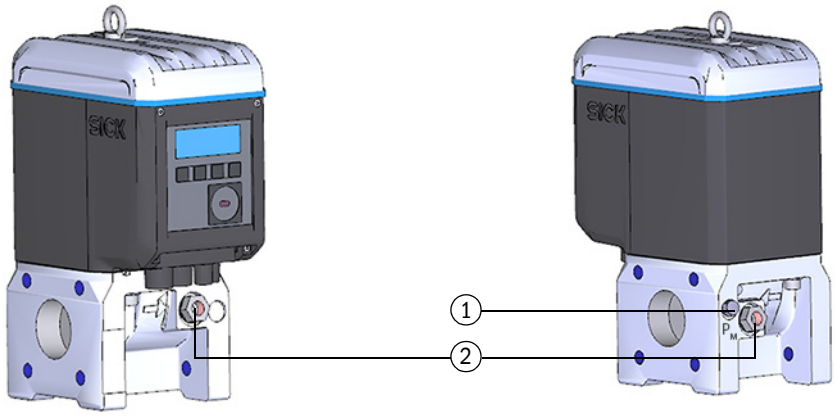
3.5 Installing the external pressure and temperature transmitters

The adapter of FLOWSIC500 has measuring ports for pressure and temperature.

NOTICE:

- The pressure measuring port to be used for measurement is marked "P_M". On meters with flow direction "left-right" (→), the marked pressure measuring port is on the rear of the adapter, on meters with flow direction "right-left" (←), it is on the front.
- Pressure and temperature transmitters can only be exchanged when the parameter locking switch is open.

Fig. 24 Pressure and temperature measuring ports (front and rear side)



1 Pressure measuring port
2 Alternative temperature measuring ports

***NOTICE:* Ensure sufficient assembly clearance!**

Ensure sufficient clearance to the wall or other components at the rear measuring ports when installing the transmitters.

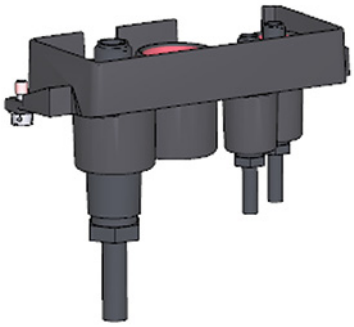
The recommended minimum clearance to the wall is 0.3 m.

3.5.1 Fitting the plug-in connector cover

Fit the plug-in connector cover before installing the transmitters.

1 Guide the transmitter plugs through the openings in the plug-in connector cover.

Fig. 25 Plug-in connector cover



2 Connect the plugs to the planned connections.

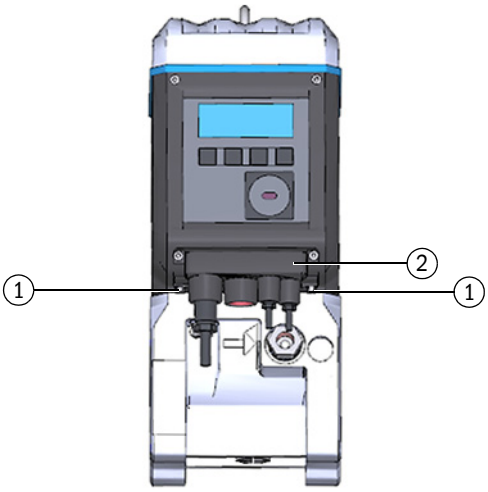
For meter sizes DN50 and DN80, it is recommended to connect the pressure transmitter to the right M8 connection and the temperature transmitter to the left M8 connection.
The FLOWSIC500 automatically detects whether a pressure or temperature transmitter has been connected to a connection.

Fig. 26 Connections for pressure and temperature transmitters

1 Connections for pressure and temperature transmitters

3 Push the plug-in connector cover over the plugs and fasten with both capstan screws.

Fig. 27 Fastening the plug-in connector cover



1 Capstan screw
2 Plug-in connector cover

3.5.2 Installing the pressure transmitter

A three-way test valve is normally fitted to be able to test the pressure transmitter.

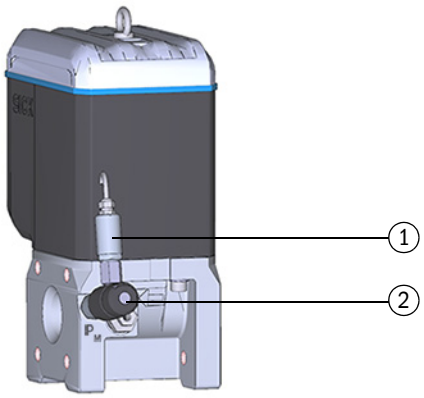
> ***NOTICE:* Fitting information**
> It is recommended to connect the pressure transmitter with the three-way test valve or with the FLOWSIC500 so that there is a downward slope from the pressure transmitter to the connection point and from the three-way test valve to the FLOWSIC500.

Variant 1: Installation with Kamstrup test valve BDA04 (up to -25 °C)

For details on installation with Kamstrup test valve BDA04, see Kamstrup Operating Instructions.
You will find the document on the delivered product CD.

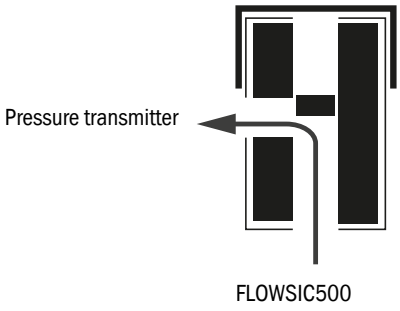
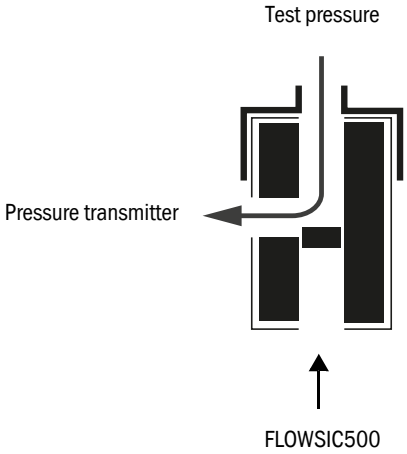
1 Remove the dummy plug on the pressure measuring port marked "P_M".
2 Fit the Kamstrup test valve BDA04.
Pay attention to the alignment of the connection for the pressure transmitter.
3 Fit the pressure transmitter on the Kamstrup test valve BDA04 (→ Fig. 28).

Fig. 28 Kamstrup test valve BDA04 with pressure transmitter fitted



1 Pressure transmitter
2 Kamstrup test valve BDA04

Table 13 Kamstrup test valve BDA04 positions

Measuring position	
Test position	

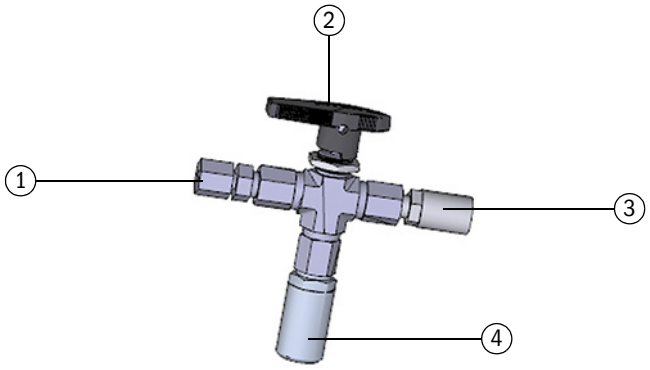
Variant 2: Installation with three-way test valve (to -40 °C)

Here, a conventional three-way test valve is used.

Install the three-way test valve with pressure transmitter fitted at a suitable location next to the FLOWSIC500. A pressure line serves to connect the pressure measuring connection of the FLOWSIC500 to the three-way test valve.

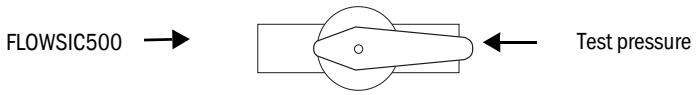
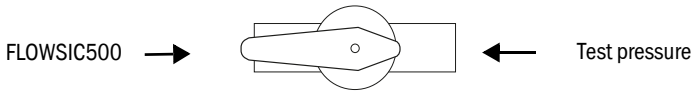
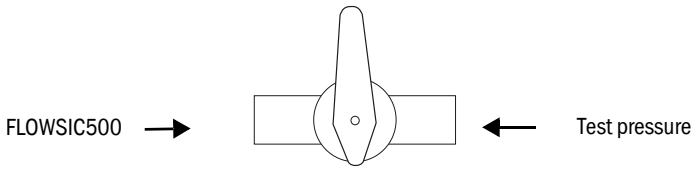
1 Fasten the three-way test valve at a suitable location.
2 Remove the dummy plug on the pressure measuring port marked "P_M".
3 Fit the supplied screw fitting.
4 Install the pressure line between the FLOWSIC500 and the three-way test valve.
5 Fit the pressure transmitter to the three-way test valve.

Fig. 29 Pressure transmitter installation on the three-way test valve (-40 °C)



1 FLOWSIC500 connection
2 Three-way test valve
3 Test connection (Minimess coupling)
4 Pressure transmitter

Table 14 Three-way test valve positions

Measuring position	
Test position	
Closed position	

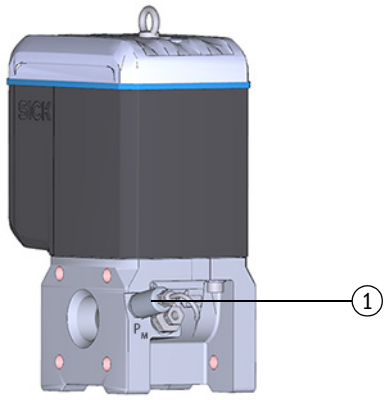
Variant 3: Installation without a three-way test valve

Here, the pressure transmitter is connected directly to the FLOWSIC500.

1 Remove the dummy plug on the pressure measuring port marked “P_M”.

2 Fit the pressure transmitter.

Fig. 30 Installation without three-way test valve



1 Pressure transmitter

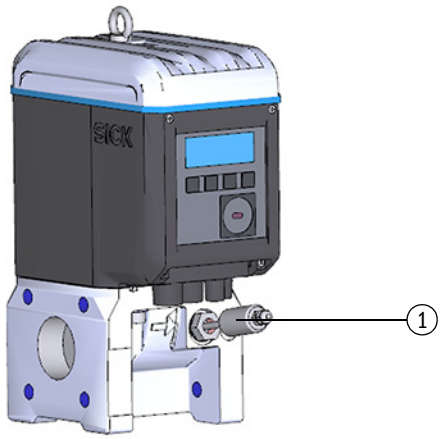
3.5.3 Installing the temperature transmitter

NOTICE:
SICK recommends to install the temperature transmitter on the temperature measuring port which is on the same side as the display.

The temperature transmitter can be greased with heat-conductive oil or paste to improve its performance.

1 Insert the temperature transmitter into the immersion sleeve to the stop.
2 Tighten the locknut.
3 Have the wire seal attached by a calibration inspector (→ Fig. 10).

Fig. 31 Installing the temperature transmitter



1 Temperature transmitter

FLOWSIC500

4 Start-up

Sequence of start-up
Setting the date and time
Configuring volume conversion (device option)
Checking the device status

4.1 Sequence of start-up

4.1.1 Start-up of gas flow meter

FLOWSIC500 start-up is normally performed in the following sequence:

- Log on as "Authorized user" (→ p. 72, § 5.2.7).
- Set the date and time (→ p. 54, § 4.2).
- Check the device status (→ p. 56, § 4.4).

4.1.2 Start-up of gas flow meter with device option volume conversion

- Log on as "Authorized user" (→ p. 72, § 5.2.7).
- Set the date and time (→ p. 54, § 4.2).
- Activate the configuration mode (→ p. 72, § 5.2.9).
- Set fixed values for pressure and temperature (→ p. 55, § 4.3.1).
- Set reference values (already configured: → Table 2).
- Select the calculation method (already configured: → p. 69, § 5.2.6.5)
- Set the fixed value of the compressibility factor (→ p. 69, § 5.2.6.5).
- Check the configuration (→ p. 56, § 4.3.3).
- Configure the gas composition (→ p. 56, § 4.3.3).
- Adapt alarm limits for pressure and temperature (→ p. 70, § 5.2.6.6 and → p. 70, § 5.2.6.7).

> The alarm limits are set in the factory to the measuring range of the selected transmitter

- Terminate configuration mode (→ p. 72, § 5.2.9).
- Check the device status (→ p. 56, § 4.4).

4.2 Setting the date and time

Date and time must be set after the power supply has been connected. The FLOWSIC500 displays error E-3007 ("Time" invalid) until the time has been set.

> Detailed information on operating using the display and on menu navigation → p. 58, § 5.2.

> - The time zone function adapts the time to the new time zone.
> If you want to change date and time as well as the time zone, change the time zone first.
> - Date and time can be changed without starting configuration mode.

1 Log on as "Authorized user" (→ p. 72, § 5.2.7).
2 Switch to the "System settings" submenu in the FLOWSIC500 menu.
3 Call up "Date".
4 Press ENTER to start the edit mode.
 The cursor now blinks under the first position of the date.
5 Use the arrow buttons to increment or decrement the selected position by 1 until the correct digit is shown.
6 Confirm with ENTER.
 The cursor now blinks under the second position of the date.
7 Repeat for the remaining positions of the date.
 The date is saved when you confirm the last position with ENTER.

8 Switch to "Time".
9 Use the arrow buttons to increment or decrement the first position of the time by 1 until the correct digit is shown.
10 Confirm with ENTER.
11 Repeat for the remaining positions of the time.
The time is saved when you confirm the last position with ENTER.

4.3 Configuring volume conversion (device option)

4.3.1 Setting fixed values

The fixed values must be set to the average measurement conditions of pressure and temperature:

1 Log on as "Authorized user" (→ p. 72, § 5.2.7).
2 Start the configuration mode → p. 72.
3 In the FLOWSIC500 menu, switch to submenu "Pressure parameters" or "Temperature parameters"
4 Select the view "p Fixed value" or "T Fixed value".
5 Press ENTER to start the edit mode.
The cursor now blinks under the first position of the parameter.
6 Use the arrow buttons to increment or decrement the selected position by 1 until the correct digit is shown.
7 Confirm with ENTER.
The cursor now blinks under the second position of the parameter.
8 Repeat for all remaining positions of the parameter.

The fixed value is saved when you confirm the last position with ENTER.

4.3.2 Checking the configuration

The FLOWSIC500 is delivered already configured according to customer specifications.

It is recommended to check the calibration-relevant parameters and settings. The calibration-relevant parameters are shown in the Data Book printout and can be compared against the current configuration on the display.

A new printout of the Data Book can be created using the FLOWgate500 operating software.

4.3.3 Configuring the gas composition

1 Log on as "Authorized user" (→ p. 72, § 5.2.7).
2 Start the configuration mode (→ p. 72).
3 Switch to submenu "Conversion/Gas composition" in the FLOWSIC500 menu.
4 Enter the following parameters according to the gas used and for the calculation method selected:
   – Rel. density or reference density
   – H2 [mol%]
   – CO2 [mol%]
   – N2 [mol%]
   – Heating value

Parameter changes are saved in the Metrology logbook when the parameter locking switch is closed.
The Metrology logbook can be viewed using the FLOWgate500 operating software.

4.4 Checking the device status

Make sure the FLOWSIC500 is in error-free operating status:

1 Log on as "Authorized user" (→ p. 72, § 5.2.7).
2 Check whether warnings or errors are shown in the symbol bar on the display.

⚠	The device has a warning. The FLOWSIC500 is in "Warning" status.
🔔	The device has an error. The FLOWSIC500 is in "Malfunction" status.

3 If warnings or malfunctions exist, change to view "Current events" on the main display:
   – Clear existing malfunctions (→ p. 78, § 6.2, “Status messages”).
   – Contact SICK Customer Service for any malfunctions you cannot clear yourself (→ p. 78, § 6.1, “Contacting Customer Service”).
4 The event overview can be reset when all warnings and errors have been cleared (→ p. 73, § 5.2.12).

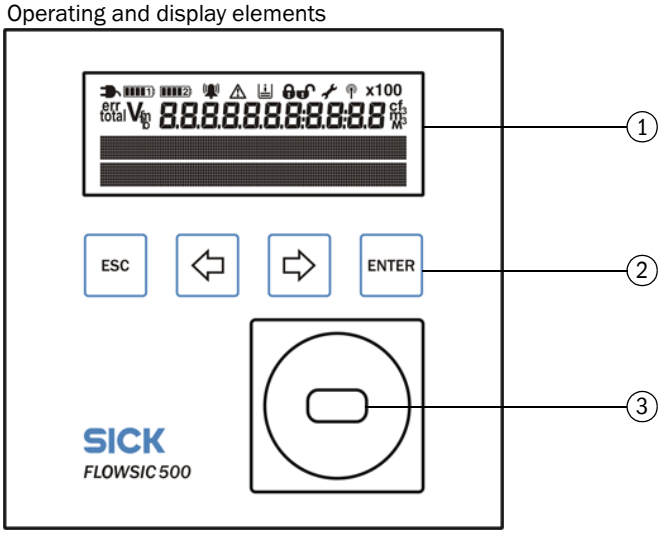
FLOWSIC500

5 Operation

Control unit
Operating using the display
Operating using the optical data interface
FLOWgate500 operating software
Parameter protection

5.1 Control unit

Fig. 32 Operating and display elements



1 Display
2 Buttons
3 Optical data interface

5.2 Operating using the display

► Press any button to switch the display on.

In battery operation, the display and the optical data interface have a timeout and switch off after approx. 60 seconds (default setting) when no button has been pressed and no data transmission takes place.
The display and the optical interface are permanently active when an external power supply is connected.

Table 15 Buttons

	In menu	In Edit mode
Esc	Returns to next higher level of the operator menu	Aborts input of new value and returns to the next higher level of the operator menu.
⇦	Toggles between single menu entries on one level	Increments or decrements a parameter by 1, toggles between several selection options.
⇨		
ENTER	Calls a submenu, starts edit mode.	Confirms an input.

5.2.1 Display in the symbol bar

Table 16 Symbols

Symbol	Significance	Description
	External power supply	Only displayed when the device is configured with external power supply.
	Battery fill level, battery 1	Displayed when the FLOWSIC500 is configured for battery operation: Status of the first battery pack Details on the battery fill level → p. 59, § 5.2.2.
	Battery fill level, battery 2	With external power supply: Backup battery status. With battery operation: Second battery pack status. Details on the battery fill level → p. 59, § 5.2.2.
	Device status: Malfunction	The device has an error, the measured value is invalid.
	Device status: Warning	The device has a warning, the measured value is still valid.
	Registered events	Events have occurred since the last event summary reset.
	Parameter locking switch closed	Metrologically relevant parameters are protected against changing; modifications are registered in the Metrology logbook → p. 24, § 2.9.2.
	Parameter locking switch open	Metrologically relevant parameters can be changed; the modifications are not saved in the Metrology logbook.
	Configuration mode	Device parameters can be changed.

NOTICE:
In device status “Malfunction” or “Warning”, the respective symbols are shown blinking on the display.

5.2.2 Battery fill level display

The battery symbol changes as the battery is discharged.

Table 17 Battery fill level display

	Battery fill level > 75%
	Battery fill level > 50%
	Battery fill level > 25%
	Battery fill level > 25%
	Battery almost empty but still in use

- The last segment of the battery symbol starts to blink when the battery fill level drops below 10%.
- When the battery is completely empty, the empty battery symbol blinks and the FLOWSIC500 has switched to the second battery.

5.2.3 Main screen (without device option volume conversion)

► Use buttons ⇦ and ⇨ to toggle between the menu entries on a level.

► Press ENTER to go down one menu level.

Main display

The following information is displayed on the top display menu level:

Main display	Description
`V 000000000 m³` `20.08.2012 10:30:52`	V = Volume absolute, cannot be reset
↳ Pressing ENTER opens the FLOWSIC500 menu.	
`errV 000000000 m³` `20.08.2012 10:30:52`	errV = Error volume: Volume counted during a malfunction, can be reset
↳ Pressing ENTER opens the action "Reset error volume". → "Resetting the error volume" (p. 73).	
`Q 0.000 m3/h` `VOG 0.000 m/s`	Q = Volume flow VOG = Gas velocity
`Current events` `1 Event`	Current events (1 event is reported)
↳ Pressing ENTER opens a list of current reported events. Use the arrow buttons to toggle through the reported events.	
`Event Summary` `2 Events`	Stored status messages: Events since the last time the event summary was reset (2 events have occurred).
↳ Pressing ENTER opens a list of stored events. Use the arrow buttons to toggle through the stored events.	
`Last Event Reset` `20.08.2012 10:30:52`	Last reset of event summary
↳ Pressing ENTER opens the action "Reset Event Summary". → "Resetting the event summary" (p. 73).	

NOTICE:

A parameter with Malfunction status is shown on the display by a blinking exclamation mark after the parameter (e. g. Q!).

Menu navigation (without device option volume conversion)

Some menu functions are only available when you are logged in with user level "User" or "Authorized User":

User level:	G	Guest (standard)	U	User (1) User (2) User (3)	A1 A2 A3	Authorized user (1) Authorized user (2) Authorized user (3)
Access rights:	-	Hidden	○	View	●	Start/edit

Path	G	U	A2+3	A1	Explanation
Main display: Volume under measurement conditions V	○	○	○	○	
FLOWSIC500 menu: User	○	○	○	○	
Logged in user level	●	●	●	●	→ p. 67, § 5.2.6.1
Login	●	●	●	●	
Logout	-	●	●	●	
FLOWSIC500 menu: Device mode	○	○	○	○	→ p. 67, § 5.2.6.2
Calibration mode	○	○	●	●	
Configuration mode	○	○	●	●	
FLOWSIC500 menu: Device information	○	○	○	○	→ p. 67, § 5.2.6.3
Measuring port	○	○	○	○	
Serial number	○	○	○	○	
Firmware Version	○	○	○	○	
Firmware Date	○	○	○	○	
Firmware CRC	○	○	○	○	
Metrology CRC	○	○	○	○	
Min. oper. pressure	○	○	○	○	
Max. oper. pressure	○	○	○	○	
Meter factor	○	○	○	○	
Frequency at Qr [Hz]	○	○	○	○	
FLOWSIC500 menu: System settings	○	○	○	○	→ p. 68, § 5.2.6.4
Power supply (1) [%]	○	○	●	●	
Power supply (2) [%]	○	○	●	●	
Date	○	○	●	●	
Time	○	○	●	●	
Timezone	○	○	●	●	
Language	○	●	●	●	
Symbols	○	○	○	○	
LCD test	○	●	●	●	
FLOWSIC500 menu: Logbooks	○	○	○	○	
Event logbook	○	○	○	○	
List of stored events	-	○	○	○	
Parameter logbook	○	○	○	○	
Metrology logbook	○	○	○	○	
FLOWSIC500 menu: Archives	○	○	○	○	→ p. 71, § 5.2.6.9
Gas hour	○	○	●	●	
Gas day	○	○	●	●	
Measuring period	○	○	●	●	
Main display: Error volumes errV	○	○	●	●	
Main display: Volume flow under measurement conditions/ gas velocity	○	○	○	○	
Main display: Current Events	○	○	○	○	
List of current events	○	○	○	○	
Main display: Event Summary	○	○	○	○	
List of stored events	○	○	○	○	
Main display: Last Event Reset	○	○	●	●	→ p. 73, § 5.2.12

5.2.4 Main display (with device option volume conversion)

► Use buttons ⇦ and ⇨ to toggle between the menu entries on a level.

Press ENTER to go down one menu level.

The symbols on the display are shown as standard in accordance with EN12405.
Symbols with regional deviations can be configured.
These Operating Instructions use symbols in accordance with EN12405.

Main display (with device option volume conversion)

The following information is displayed on the top display menu level:

Main display	Description
Vb 000000000 m³ 20.08.2012 10:30:52	V_b= Volume at base conditions, uninterrupted
↳ Pressing ENTER opens the FLOWSIC500 menu.	
$^{err}V_b$ 000000000 m³ 20.08.2012 10:30:52	$^{err}V_b$ = Error volume at base conditions
↳ Pressing ENTER opens the action "Reset error volume". → "Resetting the error volume" (p. 73).	
$^{total}V_b$ 000000000 m³ 20.08.2012 10:30:52	$^{total}V_b$ = Total volume at base conditions = V_b + $^{err}V_b$
V_m 000000000 m³ 20.08.2012 10:30:52	V_m = Total volume at measurement conditions
$^{err}V_m$ 000000000 m³ 20.08.2012 10:30:52	$^{err}V_m$ = Error volume Volume counted at measurement conditions, during a malfunction, can be reset
Q 0.000 m3/h Qb 0.000 m3/h	Q = Volume flow at measurement conditions Qb = Volume flow at base conditions
SOS 430.00 m/s VOG 0.000 m/s	SOS = Sound velocity currently measured VOG = Gas velocity currently measured

Main display	Description
p 3.532 bar T 25.42 °C	p = Pressure currently used for volume conversion T = Temperature currently used for volume conversion
C 25.7368 K 0.9541	C = Conversion factor K = Compressibility factor
Z 0.99830 Zb 0.99812	Z = Compression factor at measurement conditions currently used for volume conversion Z = Compression factor at base conditions currently used for volume conversion
Current events 1 Event	Current events (1 event is reported)
↳ Pressing ENTER opens a list of current reported events. Use the arrow buttons to toggle through the reported events.	
Event Summary 2 Events	Stored status messages: Events since the last time the event summary was reset (2 events have occurred).
↳ Pressing ENTER opens a list of stored events. Use the arrow buttons to toggle through the stored events.	
Last Event Reset 20.08.2012 10:30:52	Last reset of event summary
↳ Pressing ENTER opens the action "Reset Event Summary". → "Resetting the event summary" (p. 73).	

NOTICE:

A parameter with Malfunction status is shown on the display by a blinking exclamation mark after the parameter (e. g. Q!).

Menu navigation (with device option volume conversion)

Some menu functions are only available when you are logged in with user level "User" or "Authorized User":

User level:	G Guest (standard)	U User (1) User (2) User (3)	A1 Authorized user (1) A2 Authorized user (2) A3 Authorized user (3)
Access rights:	- Hidden	○ View	● Start/edit

Path	G	U	A2+3	A1	Explanation
Main display: Base volume Vb	○	○	○	○	
FLOWSIC500 menu: User	○	○	○	○	→ p. 67, § 5.2.6.1
Logged in user level	●	●	●	●	
Login	●	●	●	●	
Logout	-	●	●	●	
FLOWSIC500 menu: Device mode	○	○	○	○	→ p. 67, § 5.2.6.2
Calibration mode	○	○	●	●	
Configuration mode	○	○	●	●	
FLOWSIC500 menu: Device information	○	○	○	○	p. 67, § 5.2.6.3
Measuring port	○	○	○	○	
Serial number	○	○	○	○	
Firmware version	○	○	○	○	
Firmware date	○	○	○	○	
Firmware CRC	○	○	○	○	
Metrology CRC	○	○	○	○	
Min. oper. pressure	○	○	○	○	
Max. oper. pressure	○	○	○	○	
Meter factor	○	○	○	○	
Frequency at Qr	○	○	○	○	
FLOWSIC500 menu: System settings	○	○	○	○	→ p. 68, § 5.2.6.4
Power supply (1)	○	○	●	●	
Power supply (2)	○	○	●	●	
Date	○	○	●	●	
Time	○	○	●	●	
Timezone	○	○	●	●	
Language	○	●	●	●	
Symbols	○	○	○	○	
LCD test	○	●	●	●	
FLOWSIC500 menu: Conversion	○	○	○	○	→ p. 69, § 5.2.6.5
Conversion: References	○	○	○	○	
Standard pressure	○	○	●	●	
Standard temperature	○	○	●	●	
Ref. conditions	○	○	●	●	
Atmospheric pressure	○	○	●	●	
Conversion: Calculation	○	○	○	○	
Calc. methods	○	○	●	●	
Calc. interval	○	○	●	●	
K-factor (fixed)	○	○	●	●	
Conversion: Gas composition	○	○	○	○	
Density entry type	○	○	●	●	
Reference density	○	○	●	●	
Relative density	○	○	●	●	
CO2 [mol%]	○	○	●	●	
N2 [mol%]	○	○	●	●	
H2 [mol%]	○	○	●	●	
Heating value	○	○	●	●	
Heating value unit	○	○	●	●	
FLOWSIC500 menu: Pressure parameters	○	○	○	○	→ p. 70, § 5.2.6.6
p Sensor type	○	○	○	○	

Path	G	U	A2+3	A1	Explanation
p Sensor serial number	○	○	○	○	
p Lower alarm limit	○	○	●	●	
p Upper alarm limit	○	○	●	●	
p Default value	○	○	●	●	
p Unit	○	○	●	●	
p Adjust offset	○	○	●	●	
p Adjust factor	○	○	●	●	
FLOWSIC500 menu: Temperature parameters	○	○	○	○	→p. 70, §5.2.6.7
T Sensor type	○	○	○	○	
T Sensor serial number	○	○	○	○	
T Lower alarm limit	○	○	●	●	
T Upper alarm limit	○	○	●	●	
T Default value	○	○	●	●	
T Unit	○	○	●	●	
T Adjust offset	○	○	●	●	
T Adjust factor	○	○	●	●	
FLOWSIC500 menu: Logbooks	○	○	○	○	
Event logbook	○	○	○	○	
List of stored events	-	○	○	○	
Parameter logbook	○	○	○	○	
Metrology logbook	○	○	○	○	
FLOWSIC500 menu: Archives	○	○	○	○	→p. 71, §5.2.6.9
Gas hour	○	○	●	●	
Gas day	○	○	●	●	
Measuring period	○	○	●	●	
Main display: errVb	○	○	●	●	→p. 73, §5.2.11
Main display: totalVb	○	○	○	○	
Main display: Vm	○	○	○	○	
Main display: errVm	○	○	○	○	
Main display: Q/Qb	○	○	○	○	
Main display: SOS/VOG	○	○	○	○	
Main display: p/T	○	○	○	○	
Main display: C-factor	○	○	○	○	
Main display: Z/Zb	○	○	○	○	
Main display: Current Events	○	○	○	○	
List of current events	○	○	○	○	
Main display: Event Summary	○	○	○	○	
List of stored events	○	○	○	○	
Main display: Last Event Reset	○	○	●	●	→p. 73, §5.2.12

5.2.5 Configuration of main display

The configuration of the main display can be performed via the operating program FLOWgate500.

The following contents are available:

- Blank (line 1 – SICK standard)
- Date, time (line 2 – SICK standard)
- Pressure p
- Temperature T
- Conversion factor C
- Compressibility factor K
- Volume flow rate Q
- Base flow Qb
- VOG
- SOS

5.2.6 FLOWSIC500 menu

5.2.6.1 User

User	Logged in user level, without login: Guest → "Changing the user level" (p. 72) Logged in as: ● User (1) ● User (2)* ● User (3)* ● Authorized user (1) ● Authorized user (2)* ● Authorized user (3)* * when activated

5.2.6.2 Device mode

Calibration mode	Display whether calibration mode for the flow check is switched on or off, start and end calibration mode In calibration mode, message "CALIBRATION MODE" blinks on the main display with the meter factor now effective for the calibration (set at the factory). The FLOWSIC500 outputs test pulses with a maximum possible frequency of 2 kHz at 120% Q_{max}.on digital switching output DO_1 (→ p. 42, § 3.4.6.1). For flow check and calibration, see document "E_86770: Calibration Instructions for the Ultrasonic Gas Flow Meter FLOWSIC500"
Configuration mode	Display whether configuration mode is switched on or off, Starting and terminating configuration mode → "Start configuration mode" (p. 72)

5.2.6.3 Device information

Measuring port	Measuring port identifier
Serial number	Device serial number
Firmware Version	Firmware version installed on the device
Firmware Date	Firmware release date
Firmware CRC	Firmware check sum
Metrology CRC	Check sum of metrologically relevant parameters
Min. oper. pressure	Minimum operating overpressure
Max. oper. pressure	Maximum operating overpressure
Meter factor	Pulse valency, relation between frequency and flow [Imp/m^3]
Frequency at Qr	Frequency for overload flow Qr=1.2 Qmax

5.2.6.4 **System settings**

<table>
<tr><td>Power supply (1)</td><td>● For battery operation:
– Fill level for battery pack 1 [%],
– Confirm battery exchange for battery pack 1.
→ "Confirming battery replacement" (p. 74)

● With external power supply:
– Display: 100%
→ "Checking the external power supply" (p. 74)</td></tr>
<tr><td>Power supply (2)</td><td>● For battery operation:
– Fill level for battery pack 2 [%],
– Confirm battery exchange for battery pack 2.

● With external power supply:
– Fill level for backup battery
– Confirm battery exchange for backup battery.

→ "Confirming battery replacement" (p. 74)</td></tr>
<tr><td>Date</td><td>Device date → "Sequence of start-up" (p. 54)</td></tr>
<tr><td>Time</td><td>Device time → "Sequence of start-up" (p. 54)</td></tr>
<tr><td>Timezone</td><td>Time zone set on device</td></tr>
<tr><td>Language</td><td>Language for displays
Available: English, German, Russian

→ "Setting the language" (p. 72)</td></tr>
<tr><td>Symbols according to</td><td>Symbols for mesured value displays
The setting can be changed with the FLOWgate operating software.
Gas flow meter:
<table><tr><td></td><td>EN12405</td><td>PTB</td><td>GOST</td><td>API</td></tr><tr><td>Volume (measurement)</td><td>V</td><td>V</td><td>V</td><td>Vf</td></tr><tr><td>Flow (measurement)</td><td>Q</td><td>Q</td><td>Q</td><td>Qb</td></tr><tr><td>Velocity of Gas</td><td>VOG</td><td>VOG</td><td>VOG</td><td>VOG</td></tr><tr><td>Speed of Sound</td><td>SOS</td><td>SOS</td><td>SOS</td><td>SOS</td></tr></table>Gas flow meter with volume conversion
<table><tr><td></td><td>EN12405</td><td>PTB</td><td>GOST</td><td>API</td></tr><tr><td>Volume (measurement)</td><td>Vm</td><td>Vm</td><td>V</td><td>Vf</td></tr><tr><td>Volume (base)</td><td>Vb</td><td>Vb</td><td>Vc</td><td>Vb</td></tr><tr><td>Flow (measurement)</td><td>Q</td><td>Q</td><td>Q</td><td>Qb</td></tr><tr><td>Flow rate (base)</td><td>Qf</td><td>Qf</td><td>Qc</td><td>Qf</td></tr><tr><td>Pressure (measurement)</td><td>p</td><td>p</td><td>P</td><td>Pf</td></tr><tr><td>Pressure (base)</td><td>pb</td><td>pb</td><td>Pc</td><td>Pb</td></tr><tr><td>Temperature (measurement)</td><td>T</td><td>T</td><td>T</td><td>Tf</td></tr><tr><td>Temperature (base)</td><td>Tb</td><td>Tb</td><td>TC</td><td>Tb</td></tr><tr><td>Velocity of Gas</td><td>VOG</td><td>VOG</td><td>VOG</td><td>VOG</td></tr><tr><td>Speed of Sound</td><td>SOS</td><td>SOS</td><td>SOS</td><td>SOS</td></tr><tr><td>K-factor (fixed)</td><td>K</td><td>K</td><td>K</td><td>s</td></tr><tr><td>Conversion factor</td><td>C</td><td>C</td><td>C</td><td>C</td></tr><tr><td>Z (measurement)</td><td>Z</td><td>Z</td><td>Z</td><td>Zf</td></tr><tr><td>Z (base)</td><td>Zb</td><td>Zb</td><td>Zc</td><td>Zb</td></tr></table></td></tr>
<tr><td>LCD test</td><td>Display test → "Testing the display" (p. 74)</td></tr>
</table>

5.2.6.5 Conversion (only for device types with volume conversion)

References

Standard pressure	Standard pressure [unit acc. to display]
Standard temperature	Standard temperature [unit acc. to display]
Ref. conditions	Reference conditions for density and heating value Display: T1/T2/p2 T1 = Reference temperature, heating value T2 = Reference temperature, rel. density/reference density p2 = Reference pressure, rel. density/reference density
Atmospheric pressure	Ambient pressure [unit acc. to display] Input requried for version with relative pressure transmitter

	T1	T2	p2
Set 1	25 °C	0 °C	1.01325 bar (a)
Set 2	0 °C	0°C	1.01325 bar (a)
Set 3	15 °C	15 °C	1.01325 bar (a)
Set 4	60 °F	60 °F	14.7347 psi (a)
Set 5	60 °F	60 °F	14.7300 psi (a)
Set 6	25 °C	20°C	1.01325 bar (a)

Calculation

Calculation method	Calculation method for the compressibility factor Select from: ● SGERG88, ● AGA 8 Gross method 1 ● AGA 8 Gross method 2 ● AGA NX-19 ● AGA NX-19 mod. ● AGA NX-19 mod. GOST ● GERG91 mod. ● Fixed value
Calculation interval	Cycle time for updating measured values (pressure, temperature), calculation of the compressibility factor Select from: 3 s, 10 s, 20 s, 30 s, 60 s
K-factor (fixed)	Entry of K factor for method "Fixed value" when the calculation of the K-factor is incorrect.

Gas composition (only for device option volume conversion)

Density entry type	Select from: Reference density, relative density Either menu item "Reference density" or menu item "Relative density" is displayed depending on the selection.
Reference density	Gas reference density under reference conditions
Relative density	Relative density, relation between gas density and air density under reference conditions
CO2	CO_2 - proportion in gas [mol%]
N2	N_2 - proportion in gas [mol%]
H2	H_2 - proportion in gas [mol%]
Heating value	Gas heating (under reference conditions)
Heating value unit	Heating value unit Select from: Default, MJ/m³, kWh/m³, BTU/ft³ Default = Standard setting according to selected unit system (SI or US), configured in accordance with the order

The calculation method selected determines the permissible entry limits for gas proportions as well as pressure and temperature.

5.2.6.6 **Pressure parameters (only for device option volume conversion)**

p Sensor type	Display of configured pressure transmitter
p Sensor serial number	Pressure transmitter serial number expected by the device, preset
p Lower alarm limit	Lower alarm limit for pressure transmitter
p Upper alarm limit	Upper alarm limit for pressure transmitter
p Default value	Fixed value for measurement pressure [unit acc. to display] The entry value is used as fixed value for configuration as TZ conversion and for pressure measurement malfunctions.
p Unit	Unit for pressure values, used for entry and display Select from: Default, bar, psia, kPa, MPa, kg/cm2, psig Default = Standard setting according to selected unit system (SI or Imperial), configured in accordance with the order
p Adjust offset	Calibration offset for pressure transmitter [unit acc. to display]
p Adjust factor	Calibration factor for pressure transmitter

5.2.6.7 **Temperature parameters (only for device option volume conversion)**

T Sensor type	Display of configured temperature transmitter
T Sensor serial number	Temperature transmitter serial number expected by the device, preset
T Lower alarm limit	Lower alarm limit for temperature transmitter
T Upper alarm limit	Upper alarm limit for temperature transmitter
T Default value	Fixed value for measurement temperature [unit acc. to display] The entry value is used as fixed value for malfunctions of temperature measurement.

T Unit	Unit for temperature values, used for entry and display Select from: Default, ° C, ° F, K, °R Default = Standard setting according to selected unit system (SI or Imperial), configured in accordance with the order

T Adjust offset	Calibration offset for temperature transmitter [unit acc. to display]
T Adjust factor	Calibration factor for temperature transmitter

5.2.6.8 Logbooks

Event logbook	Number of entries currently stored/max. number Pressing ENTER opens the detailed view. The detailed view shows the event type, a short text and the timestamp.
Parameter logbook	Number of entries currently stored/max. number
Metrology logbook	Number of entries currently stored/max. number

5.2.6.9 Archives

Gas hour	Billing hour for the day archive Entry range: 00:00 ... 23:59 Default: 06:00
Gas day	Billing day for month archive Measuring range: 1 ... 28 Default: 1
Measuring period	Defines the period for the billing archive Select from: 3 min, 5 min,15 min, 30 min, 60 min Default: 60 min

5.2.7 Changing the user level

1 Call up menu function "User".
2 Press ENTER to start the edit mode.
3 Use the arrow buttons to select the desired user level.
4 Confirm with ENTER.
The cursor now blinks under the first position of the password.
5 To enter the password:
– Use the arrow buttons to increment or decrement the first position of the password by 1 until the correct digit is shown.
– Confirm with ENTER.
The cursor now blinks under the second position of the password.
– Repeat for the remaining positions of the password.
– You are logged in with the selected user level after the last position of the password is confirmed.

The following users are set at the factory:
- User (1), password: 1111
- Authorized user (1), password: 2222

► Change the password after the first logon via the FLOWgate operating software.

5.2.8 Setting the language

1 Switch to the "System settings" submenu in the FLOWSIC500 menu.
2 Call up "Language".
3 Press ENTER to start the edit mode.
4 Use the arrow buttons to select the desired language.
5 Confirm with ENTER.
The display texts are now shown in the selected language.

5.2.9 Changing the device mode

On the FLOWSIC500, the device modes Configuration and Calibration can be activated independently from each other.

5.2.9.1 Starting and terminating configuration mode

Start configuration mode

1 Switch to the "Device mode" submenu in the FLOWSIC500 menu.
2 Call up "Configuration mode".
3 Press ENTER to start the edit mode.
4 Use the arrow buttons to select ON.
5 Confirm with ENTER.
The configuration mode is started.
Symbol is displayed in the symbol bar.

Terminate configuration mode

1 Call up "Configuration mode".
2 Use the arrow buttons to select OFF.
3 Confirm with ENTER.
The configuration mode is terminated.

5.2.9.2 Starting and terminating calibration mode

Calibration mode can be started and terminated in the same manner as the configuration mode (→ p. 73, §5.2.9.2).

In calibration mode, message "CALIBRATION MODE" blinks on the main display with the meter factor now effective for the calibration (set at the factory).

The FLOWSIC500 outputs test pulses with a maximum possible frequency of 2 kHz at 120% Q max.on digital switching output DO_1 (→ p. 42, §3.4.6.1).

5.2.10 Changing parameters

Numerical values

1 Start the configuration mode → p. 72.
2 Select the desired parameter in the menu.
3 Press ENTER to start the edit mode.
The cursor now blinks under the first position of the parameter.
4 Use the arrow buttons to increment or decrement the selected position by 1 until the correct digit is shown.
5 Confirm with ENTER.
The cursor now blinks under the second position of the parameter.
6 Repeat for all remaining positions of the parameter.

Selection lists

1 Start the configuration mode → p. 72.
2 Select the desired parameter in the menu.
3 Press ENTER to start the edit mode.
4 use the arrow buttons to switch to the desired selection.
5 Confirm with ENTER.

5.2.11 Resetting the error volume

1 Switch to the error volume display on the main screen.
2 Press ENTER to start the edit mode.
3 Use the arrow buttons to select OK.
4 Confirm with ENTER.
The error volume is reset.

5.2.12 Resetting the event summary

1 Switch to the "Event Summary " display on the main display.
2 Press ENTER to open a list of the stored events.
3 Press ENTER to start the edit mode.
4 Use the arrow buttons to select OK.
5 Confirm with ENTER.
The event summary is reset.

5.2.13 Confirming battery replacement

Confirm battery replacement on the display after you have changed a battery.

1 Switch to the "System settings” submenu in the FLOWSIC500 menu.
2 Switch to the status indicator of the replaced batteries, e.g. "Power Supply (1)”.
3 Press ENTER to start the edit mode.
4 Use the arrow buttons to select OK.
5 Confirm with ENTER.

5.2.14 Checking the external power supply

An external power supply connected to the meter can be checked as follows:

1 Switch to the "System settings” submenu in the FLOWSIC500 menu.
2 Select “Power supply (1)” with the arrow buttons and confirm with ENTER.
3 Select “Check ext.power supply” and confirm with ENTER.

5.2.15 Testing the display

1 Switch to the "System settings” submenu in the FLOWSIC500 menu.
2 Call up "LCD Test”.
3 Press ENTER to start the display test.
All display segments on the display are activated and deactivated three times. Defective display segments can thus be detected.

5.3 Operating using the optical data interface

A data connection can be established with the device using the optical data interface and the infrared/USB adapter HIE-04 (part no. 6050502).

This interface serves to configure the FLOWSIC500. The infrared adapter has a USB 2.0 interface. This interface provides the connection to the PC and transfers the FLOWSIC500 data.

A driver must first be installed to operate the adapter on a PC.
You will find the driver on the delivered product CD.

1 Do not connect the USB connector yet. First install the driver.
2 Connect the USB connector to the PC.
3 Fit the infrared adapter to the infrared interface as shown (→ Fig. 33); a magnet integrated in the reading head retains the adapter.

Fig. 33 Alignment of the infrared adapter

4 Press any button on the display to activate the optical data interface on the FLOWSIC500.
5 Start the connection on the PC.
When a connection has been established, the optical data interface on the FLOWSIC500 remains active until the adapter is removed.
The display and the optical interface remain active during the connection.

5.4 FLOWgate500 operating software

For information concerning the FLOWgate500 operating software, see "Software Manual FLOWgate500".
The Software Manual is on the delivered Product CD.
The Software Manual is also available using the Help function of the FLOWgate500 operating software.

If the user is not an administrator, the following entries in the registry must exist or be configured for installation of the system:
- AlwaysInstallElevated = 1
- EnableUserControl = 1

Support: http://msdn.microsoft.com/en-us/library/aa367561(v=vs.85).aspx

FLOWSIC500

6 Clearing Malfunctions

Contacting Customer Service
Status messages
Additional messages in the Event logbook

6.1 Contacting Customer Service

Contact SICK Customer Service for any malfunctions you cannot clear yourself.

- In Germany:
  E-mail: pa-support@sick.de
  Phone: +49 (0) 211 – 5301 – 401
- In other countries:
  Contact your local SICK subsidiary or technical support:
  E-mail: helpdesk.pa@sick.de
  Phone: +49 (0)7641 469 1277

A diagnosis file can be created with the FLOWgate operating software which helps Customer Service to better understand malfunctions that occur. For information concerning the FLOWgate500 operating software, see "Software Manual FLOWgate500".

6.2 Status messages

Table 18 Information messages

Status message	Description/clearance
I-1017	The device firmware has been changed.
I-1018	The device has been started.
I-1019	Configuration mode is active. → p. 72, § 5.2.9.1, “Starting and terminating configuration mode”
I-1020	The parameter locking switch is open.→ p. 24, § 2.9.1,“Parameter locking switch”

Table 19 Warning messages

Status message	Description/clearance
W-2001	The Event logbook is up to 90% full. The Event logbook can be viewed, stored and reset with operating software FLOWgate500.
W-2002	The Metrology logbook is full. Calibration-relevant parameters can only be modified after the parameter locking switch has been opened. The Metrology logbook can be reset using the operating software FLOWgate500. → p. 77, § 6 “Clearing Malfunctions”
W-2003	More pulses than permissible should be output on the pulse output. Check whether the current flow rate is higher than the max. flow. If the flow is within the permissible range, check whether the selected output scaling (= pulse factor) is correct. → p. 78, § 6.1 “Contacting Customer Service”
W-2008	Flow measurement is in status "Warning". Have the device checked by Customer Service. → p. 78, § 6.1 “Contacting Customer Service”
W-2009	The measured flow rate is outside the set warning limits. Check the current measuring conditions or adjust the limits. The warning limits can be set using the operating software FLOWgate500. W-2009 = flow rate below warning limit, W-2010 = flow rate above warning limit.
W-2010	
W-2016	Battery 1 failure. → p. 85, § 7.3.2 “Changing the battery packs”

Status message	Description/clearance
W-2017	Battery 2 failure. ● With external power supply: → p. 84, § 7.2.2 “Changing the backup battery” ● For battery operation: → p. 85, § 7.3.2 “Changing the battery packs”
W-2018	External power supply failure. Check the connection and function of the external power supply. → p. 44, § 3.4.8 “Operation with external power supply”.

Table 20 Error messages

Status message	Description/clearance
E-3001	The Event logbook is full. Check the Event logbook. The Event logbook can be reset using the operating software FLOWgate500.
E-3006	Checksum error → p. 78, § 6.1 “Contacting Customer Service”.
E-3007	Time invalid → p. 54, § 4.1 “Sequence of start-up”.
E-3009	The FLOWSIC500 is in calibration mode. → p. 73, § 5.2.9.2, “Starting and terminating calibration mode”.
E-3010	Temperature transmitter failure. The FLOWSIC500 uses the default value specified. → p. 100, § 7.6 “Exchanging an external pressure or temperature transmitter” → p. 78, § 6.1 “Contacting Customer Service”.
E-3012	Pressure transmitter failure. The FLOWSIC500 uses the default value specified. → p. 100, § 7.6 “Exchanging an external pressure or temperature transmitter” → p. 78, § 6.1 “Contacting Customer Service”.
E-3013	Device is outside the permissible measurement pressure range. Check Pmin/Pmax vs. pressure.
E-3014	Flow measurement is in status "Malfunction", → p. 78, § 6.1 “Contacting Customer Service”.
E-3017	The K-factor cannot be calculated. Check the values entered for gas composition against the reference conditions and the base conditions. → p. 62, § 5.2.4 “Main display (with device option volume conversion)”.
E-3018	Reverse flow The measured creep volume (reverse flow) is larger than the preconfigured buffer volume.→ p. 19 If larger reverse flows occur regularly, contact Customer Service to have the preconfigured volume adapted. → p. 78, § 6.1 “Contacting Customer Service”.
E-3019	The measured gas temperature/gas pressure is outside the permissible limits. E-3019 = Gas temperature is below the alarm limit E-3020 = Gas temperature is above the alarm limit E-3021 = Gas pressure is below the alarm limit E-3022 = Gas pressure is above the alarm limit Check the set alarm limit values. → p. 70, § 5.2.6.7 "Temperature parameters"
E-3020	
E-3021	
E-3022	

6.3 Additional messages in the Event logbook

The FLOWSIC500 saves all status messages (→ p. 78, § 6.2) as well as further supplementary messages concerning events and status changes in the Event logbook.

Each message code is supplemented with a (+) or (-) to identify an incoming message = (+) or an outgoing message = (-).

Table 21 Information messages in the Event logbook

Status message	Description/clearance
I-1001	Event logbook has been reset
I-1002	Parameter logbook has been reset.
I-1003	Metrology logbook has been reset.
I-1004	Measuring period archive has been reset.
I-1005	Daily archive has been reset.
I-1006	Monthly archive has been reset.
I-1010	Event overview has been reset.*)
I-1011	Time has been reset.*)
I-1012	Totalizers have been reset.
I-1013	Error volume totalizers have been reset.*)
I-1014	All parameters have been reset or a group of parameters have been reset.*)
I-1021	Battery (1) has been replaced.
I-1022	Battery (2) has been replaced.
I-1023	Totalizers have been preset.*)

Table 22 Warning messages in the Event logbook

Status message	Description/clearance
W-2011	The number of valid measurements (performance of flow measurement) is significantly lower than normal.*)
W-2012	Flow measurement is performed at reduced speed.*)
W-2013	Flow rate higher than 120% Q_{max}.

Table 23 Error messages in Event logbook

Status message	Description/clearance
E-3002	Check sum of totalizers is invalid.
E-3003	Check sum of firmware is invalid.
E-3004	Parameter is invalid.*)
E-3005	Check sum of logbooks/archives is invalid.*)
E-3015	Hardware error in flow measurement.*)
E-3016	Number of valid measurements (performance of flow measurement) is not sufficient.*)

In the Event logbook, additional data, e.g. status, meter levels, measured values and parameters at the time of certain events are saved.

These events or messages are identified with *). The data can be viewed and saved with operating software FLOWgate500 (→ p. 75, § 5.4).

FLOWSIC500

7 Maintenance and Meter Replacement

Information on handling lithium batteries
Maintenance when using external power supply
Maintenance when using battery power supply
Meter exchange
Function check of a pressure or temperature transmitter
Exchanging an external pressure or temperature transmitter

7.1 Information on handling lithium batteries

WARNING: Risk of of ignition due to electrostatic charge

Make sure to minimize electrostatic risks when handling the plastic portable battery packs.

- When a static-generating mechanism is identified, such as repeated brushing against clothing, take suitable precautions, e.g.the use of anti-static footwear.
- Activities such as placing the item in a pocket or on a belt, operating a keypad or cleaning with a damp cloth, do not present a significant electrostatic risk.

WARNING: Risk of explosion - hazard for intrinsic safety

- Only the exchangeable battery packs from SICK with part no. 2064018 and the backup battery withy part no. 2065928 may be used.
- Do not use damaged batteries; they must be disposed of correctly!

WARNING:

Do not transport used battery packs by air freight!

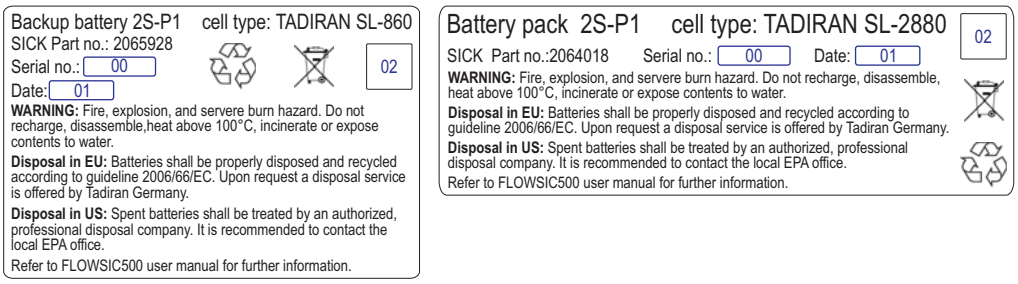
- Always remove used battery packs before shipment of the complete FLOWSIC500 measuring systems or the gas flow meter.
- For weight reasons, the battery packs should always be removed before transport by air.

The battery packs are marked with important information concerning storage and disposal.

Table 24 Marking

Symbol	Significance
	Do not dispose with household trash.
	Recycling

Fig. 34 Identification of battery packs



Variable	Description
00	Serial No.
01	Date
02	QR-Code → Order No. + 00

7.1.1 Information on storage and transport

- ► Prevent a short circuit of the battery terminals:
  - Store and transport the batteries in their original packaging
  - or tape the battery terminals.
- ► Store cool (under 21 °C (70 °F)), dry and without major temperature fluctuations.
- ► Protect against permanent sunlight.
- ► Do not store near the heating.

7.1.2 Disposal information

In the EU

- ► Dispose of lithium batteries in accordance with the Battery Directive 2006/66/EU.
- ► In Germany, you can hand in the batteries at your local recycling center.

  Alternatively, the battery manufacturer Tadiran Germany offers a return service on request.

  Contact data:

  Phone: +49 (0)6042/954-122

  Fax: +49 (0)6042/954-190

  www.tadiranbatteries.de

In the USA

- ► Batteries have to be disposed of by an authorized waste disposal company.

  Identification of lithium batteries:
  - Proper shipping name: Waste lithium batteries
  - UN number: 3090
  - Label requirements: MISCELLANEOUS, HAZARDOUS WASTE
  - Disposal code: D003
- ► If anything is unclear, contact the local office of the Environmental Protection Agency (EPA).

In other countries:

Please observe national regulations for the disposal of lithium batteries.

7.2 Maintenance when using external power supply

7.2.1 Service life of backup battery

When new, the capacity of the backup battery has been calculated for bridging up to 3 months failure of the supply voltage. When voltage supply is not interrupted, the service life is at least 10 years when stored at approx. 25 °C (77 °F).

Repeated, even short-time voltage failure reduces the remaining buffer capacity of the battery so that exchange is recommended.

If both the supply voltage and the backup battery fail, the clock setting is lost and the FLOWSIC500 does not measure anymore. Meter readings determined until then and parameter settings remain permanently stored.

7.2.2 Changing the backup battery

WARNING: Risk of explosion - hazard for intrinsic safety

► Only the exchangeable battery packs from SICK with part nos. 2064018 and the backup battery with part no. 2065928 may be used.

1 Ensure external voltage supply.
2 Open the electronics cover (→ p. 39, § 3.4.3)
3 Loosen the connection of the backup battery.
4 Remove the backup battery.
5 Insert a new backup battery and connect the battery to connection BAT2.
6 Close the electronics cover (→ p. 39, § 3.4.3)
7 Confirm battery replacement on the display (→ p. 74, § 5.2.13).

NOTICE:

The battery symbol on the display shows full straight away after the battery change.

The check whether the battery is really operational then takes 20 minutes.

7.3 Maintenance when using battery power supply

7.3.1 Service life of battery packs

Under typical operating conditions, the expected total service life of both battery packs is 5 years.

The FLOWSIC500 needs more power

- when the display is used frequently,
- when the infrared interface is used,
- when the encoder output is frequently used (scanning cycles < 15 min).

When the electrically isolated NAMUR output (DO_0) is used, an external voltage supply is recommended due to the significantly higher power requirement.

The capacity of the batteries is reduced in unfavorable climatic conditions, for example when the temperatures are significantly higher or lower than 25 °C (77 ° F).

The complete failure of both battery packs results in the loss of the clock settings and the FLOWSIC500 does not measure anymore.
Meter readings determined until then as well as the parameter settings remain permanently stored.

7.3.2 Changing the battery packs

WARNING: Risk of explosion - hazard for intrinsic safety
► Only the exchangeable battery packs from SICK with part no. 2064018 and the backup battery with part no. 2065928 may be used.

The charge level of the battery packs is shown as a symbol on the display.

Table 25 Battery fill level

Symbol	Significance	Description
	Battery pack 1 fill level (connection BAT1)	Details on the battery fill level → p. 59, § 5.2.2.
	Battery pack 2 fill level (connection BAT2)	

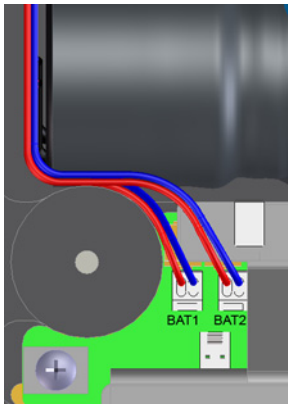
The second battery pack is activated automatically when the first pack is completely empty.

When one battery pack is empty, at least this battery pack should be changed. Both battery packs must be changed at the latest when the second battery pack is running low.

1 Check on the display which battery pack is empty.
2 Open the electronics cover (→ p. 39, § 3.4.3)
3 Loosen *only* the respective terminal connection of the empty battery pack.

NOTICE:
Only loosen one connection at a time to ensure continuous voltage supply!
If both battery packs are to be exchanged at the same time, first replace the empty battery pack and then the still used battery pack.

Fig. 35 Battery connections on the circuit board



4 Remove the battery pack and replace by the new one.

5 Reconnect the electrical system.

The FLOWSIC500 now continues to use the second battery pack and then switches back to the new battery pack.

6 Close the electronics cover (→ p. 39, § 3.4.3)

7 Confirm battery replacement on the display (→ p. 74, § 5.2.13).

NOTICE:

The battery symbol on the display shows full straight away after the battery change.

The check whether the battery is really operational then takes 20 minutes.

7.4 Meter exchange

7.4.1 Prerequisites for meter replacement

NOTICE:
Ensure that the meter replacement is carried out according to the national regulations for Ex and pressure applications of your country.

7.4.2 Hazards during meter replacement

WARNING: Hazards due to combustible gases or high pressure
Natural gas under line pressure flows through the gas flow meter during running operation. The gas flow meter may only be replaced when the equipment is at a standstill.

Before commencing installation work:

- ► Ensure the pipeline is free from pressure and free from combustible gases.
- ► Purge the pipeline with inert gas if necessary.
- ► Observe the safety information in §1.1 (→ p. 10) and §3.1 (→ p. 30).

NOTICE:
The gas flow meter may only be replaced by skilled persons who, based on their technical training and knowledge in pipeline construction as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

- ► Observe the information in §1.4 (→ p. 13).
- ► In case of doubt, please contact the local SICK Customer Service.

7.4.3 Sequence of meter replacement

To exchange the gas flow meter, proceed as follows:

1. Download the user-specific configuration of the installed gas flow meter (→ p. 90, § 7.4.6).
2. Disconnecting electrical connections (→ p. 90, § 7.4.7).
3. Removing the installed gas flow meter (→ p. 91, § 7.4.8).
4. Installing the replacement gas flow meter (→ p. 95, § 7.4.9).
5. Performing a leak tightness check (→ p. 97, § 7.4.10).
6. Connect the new gas flow meter to the electric system (→ p. 37, § 3.4).
7. Upload the user-specific configuration of the previously installed gas flow meter to the new gas flow meter (→ p. 90, § 7.4.6).
8. Check the function of the gas flow meter (→ p. 99, § 7.4.11).
9. If necessary, secure metrologically (→ p. 99, § 7.4.12).

7.4.4 Required tools and auxiliary material

- Meter replacement set (item numbers → p. 106, § 8.2.1) with:
  - Test cap for the respective meter size (→ Fig. 36, component no. 9)
  - Socket wrench
  - Allen key

Table 26 Openings

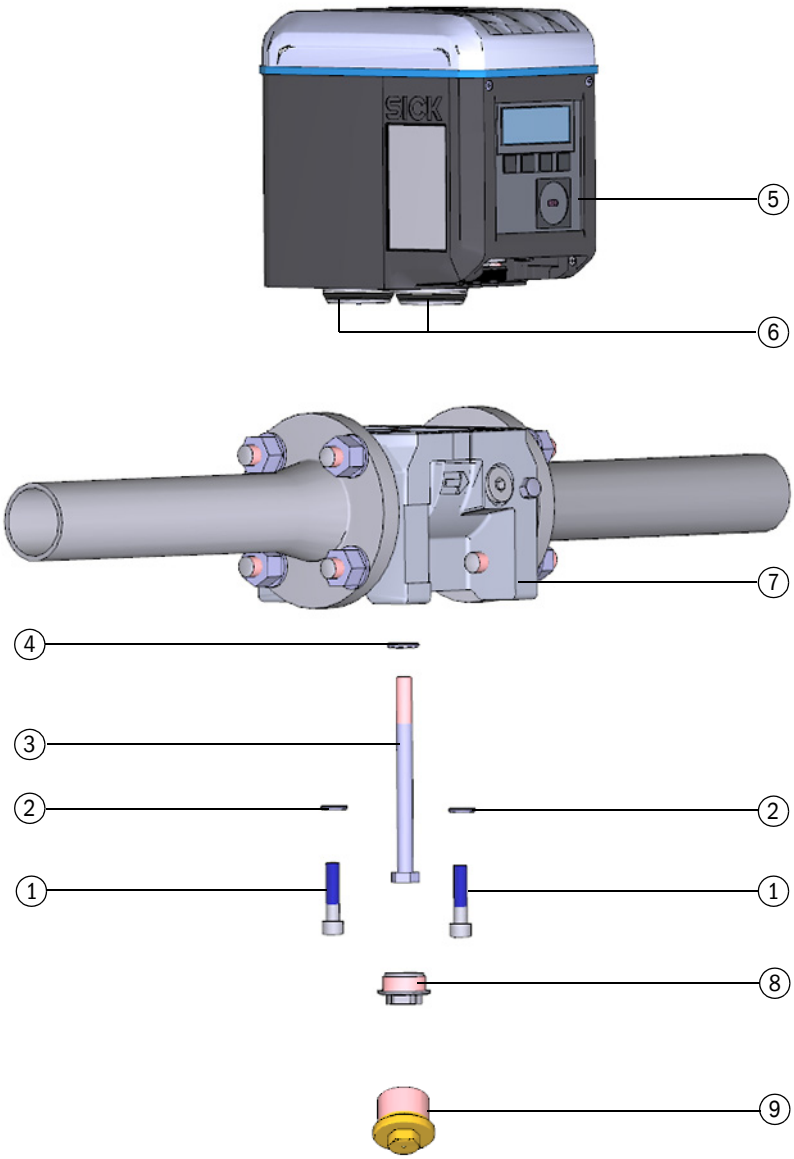
Meter size	Socket wrench	Allen key
DN50/2"	19	8
DN80/3"	24	10
DN100/4"	30	14
DN150/6"		

- Torque wrench
- Transport protection for the gas flow meter with a safety strap (item numbers → p. 105, § 8.1.3)
- Silicone grease
- Leak detection spray
- Anti-seize paste, metal-free or suitable for aluminium, e.g. OKS 235, to prevent thread mountings seizing up

> ***NOTICE:***
> Do not use copper paste!

7.4.5 Overview

Fig. 36 Components for meter replacement using DN50/2" as example



1 Securing screws
2 Ripplock washers
3 Center bolt
4 Ripplock washer
5 Gas flow meter
6 Connecting pieces with seals
7 Adapter
8 Locking cap
9 Test cap

7.4.6 Back-up of user-specific configuration of installed gas flow meter

► Use the operating software FLOWGate500 to download the customer-specific configuration of the installed gas flow meter and to save it as file.

You can use the file later to set user-specific configurations in the new gas flow meter.

► After installation of the replacement gas flow meter, upload the user-specific configuration of the previously installed gas flow meter to the new gas flow meter (see Software Manual FLOWGate500, §13, “Meter replacement”).

7.4.7 Disconnecting electrical connections

Observe the safety information in §3.4 (→ p. 37)!

Depending on the configuration of your FLOWSIC500, proceed as follows:

1 Disconnect the potential equalization line at the outer ground terminal (on the right of the M12 plug-in connections) of the electronic housing (→ Fig. 18, p. 41).

2 If installed, remove the plug-in connector cover. To do so, loosen the capstan screws (→ Fig. 27, p. 47).

3 If installed, manually loosen and remove the M12 plug-in connectors for external power supply and the signal output (→ Fig. 18, p. 41).

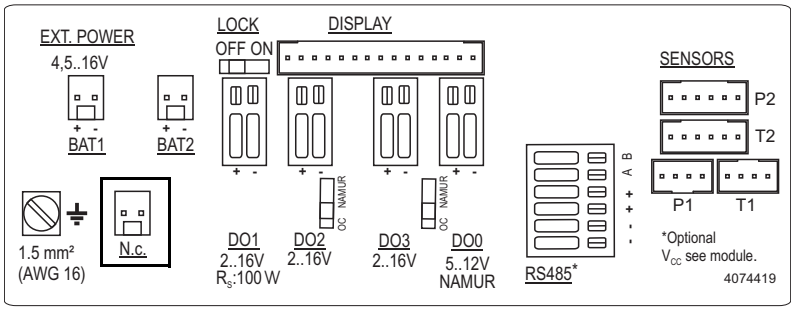
4 If installed, manually loosen and remove the plug-in connectors of the pressure and temperature transmitters (→ Fig. 18, p. 41).

5 Open the electronics cover (→ p. 39, § 3.4.3).

► Configuration with external power supply and back-up battery:

Switch the back-up battery to “N.c.”.

Fig. 37 Switching the back-up battery



► Self-sufficient power configuration with battery packs:

Remove the battery packs and dispose of or store properly according to → p. 82, § 7.1.

SICK recommends inserting new batteries during every meter replacement.

6 Close the electronics cover again (→ p. 39, § 3.4.3).

7.4.8 Removing the installed gas flow meter

1 Ensure safe conditions.

WARNING: Hazards due to combustible gases or high pressure

Natural gas under line pressure flows through the gas flow meter during running operation. The gas flow meter may only be replaced when the equipment is at a standstill.

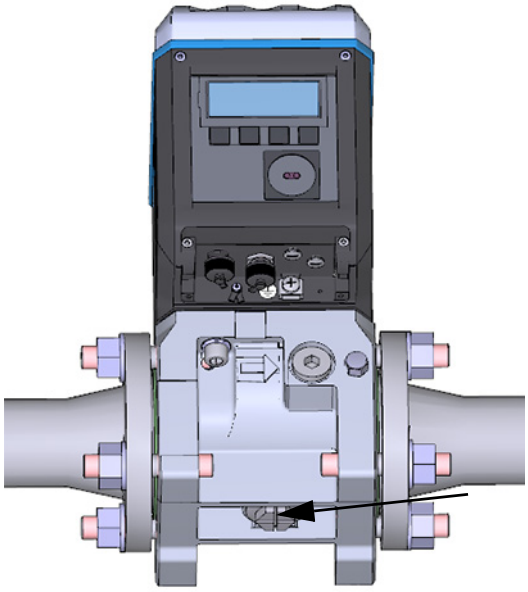
Before commencing installation work:

- ► Ensure the pipeline is free from pressure and free from combustible gases.
- ► Purge the pipeline with inert gas if necessary.
- ► Observe the safety information in §1.1 and §3.1.

WARNING: Hazard due to the gas flow meter falling down

- ► Secure the gas flow meter before loosening the screw fitting, e.g. by supporting the gas flow meter or with the help of another person holding the gas flow meter.

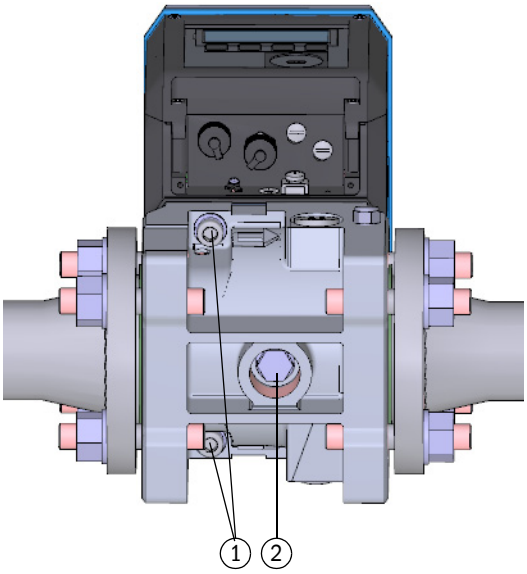
2 Unscrew the closure cap.



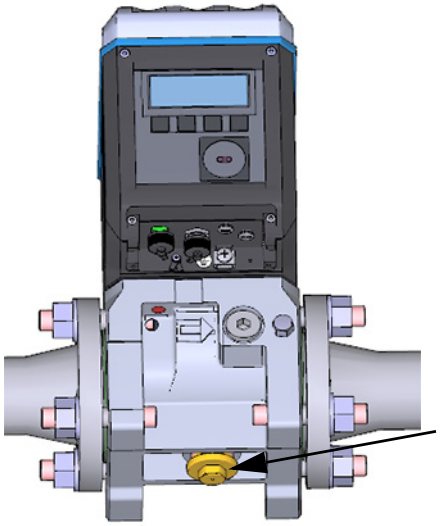
3 Remove securing screws (1) with the Allen key

Meter size	Number of securing screws
DN50	2
DN80	3
DN100	4
DN150	4

4 Loosen center bolt (2) five to six turns.

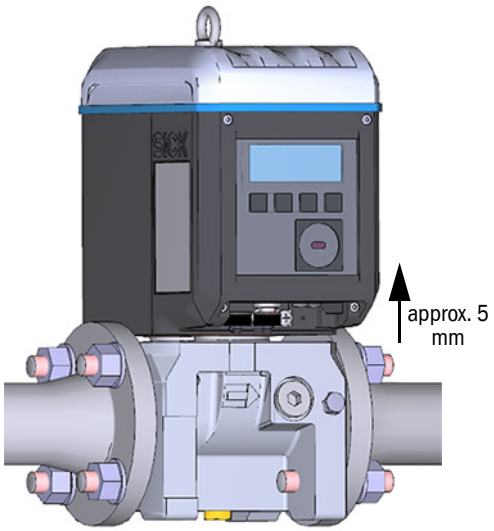


5 Instead of the closure cap, at first manually screw the test cap for the respective meter size in until the test cap touches the center bolt.

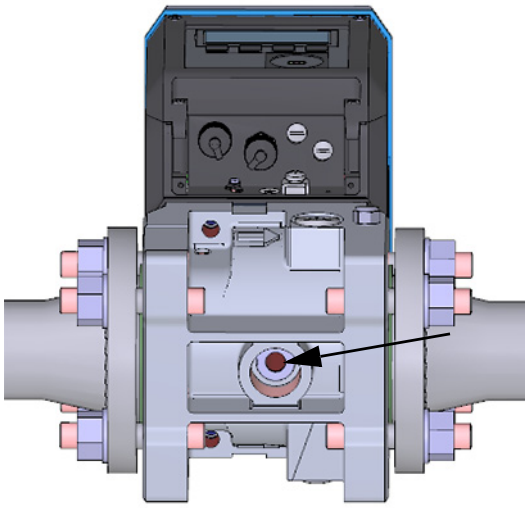


6 Keep on screwing the test cap in with the socket wrench against the resistance of the center bolt until the test cap is completely screwed in.

The center bolt pushes the seals upwards and lifts the gas flow meter up.

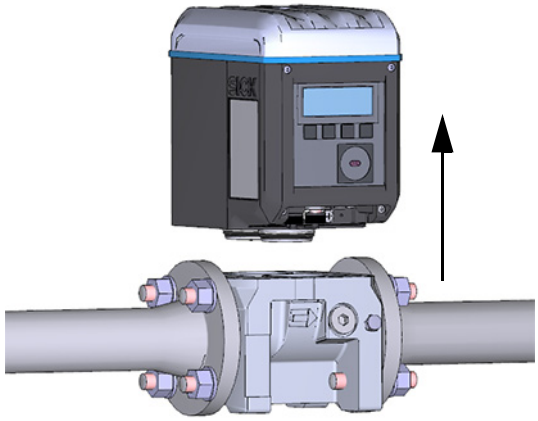


7 Unscrew the test cap and the center bolt completely with the socket wrench.



8 Pull the gas flow meter straight upwards and remove it.

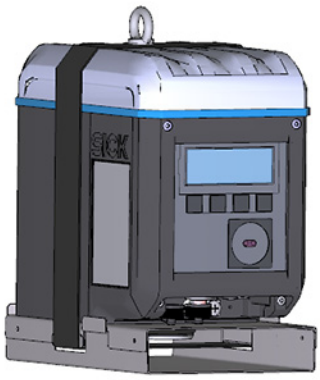
9 Ensure that the connecting pieces with the O-rings are still on the gas flow meter.



10 Ensure that the gas flow meter can not be contaminated or damaged at any time.

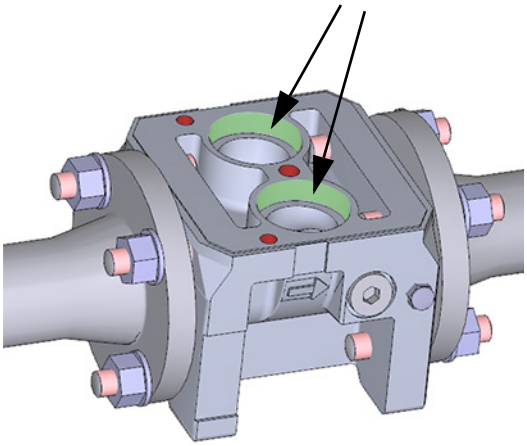
11 Secure the removed gas flow meter with the transport protection before shipping:

- Fit the gas flow meter on the transport protection.
- Secure the gas flow meter with the strap provided.



12 Check the sealing surfaces on the adapter (marked green):

- When the sealing surfaces are contaminated, clean carefully.
- Ensure that the sealing surfaces are undamaged. They have to be free of scratches or grooves.



WARNING: Hazard of leaks

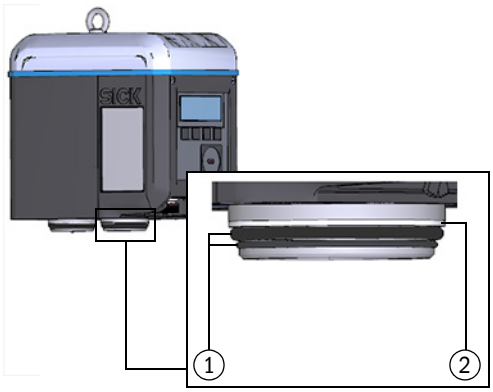
There is a risk of the installation becoming leaky when the sealing surfaces of the adapter are damaged. Operation in leaky condition is not allowed and potentially dangerous.

- ► In this case, the adapter has to be exchanged.
- ► Please contact your local SICK Customer Service.

7.4.9 Installing the replacement gas flow meter

NOTICE:
When the sealing surfaces of the adapter have been cleaned with a detergent, let it evaporate completely.

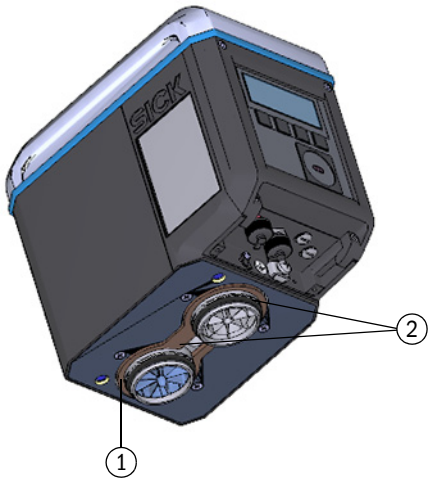
1 Carefully remove the transport protection of the new gas flow meter. Pay attention to the arrangement of O-ring seals (1) and support plates (2).



2 Check the outside of the replacement gas flow meter for transport damage.
Only undamaged gas flow meters may be installed.

3 Ensure that flat sealing (1) and the O-rings on connection pieces (2) are not damaged.

4 Check all threads on the components for damage.

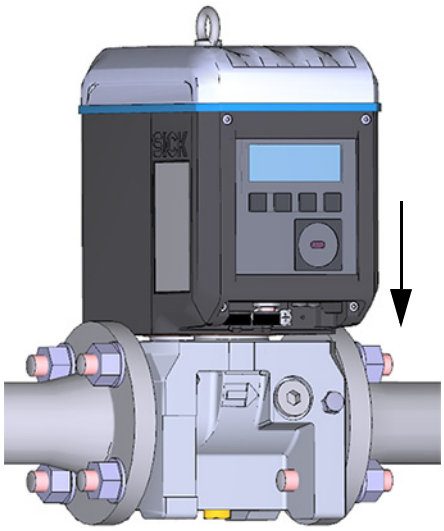


5 Apply silicone grease to the sealing surfaces of the adapter.

6 Apply silicone grease to the O-rings on the connection pieces.

7 Carefully fit the gas flow meter on the adapter.
Pay attention to the correct orientation of the gas flow meter. The position of the center bolt allows only one fitting direction.

8 Carefully plug the connection pieces with the O-rings into the openings of the adapter.

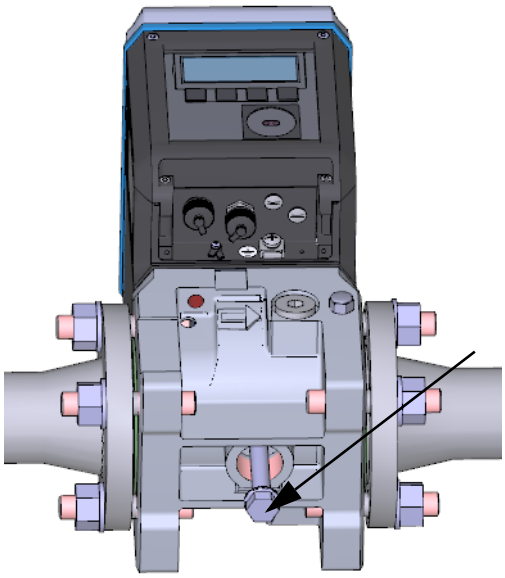


9 First screw the provided new center bolt with Ripplock washer in manually.

SICK recommends using anti-seize paste.

10 Then tighten the center bolt with the socket wrench to the specified tightening torque.

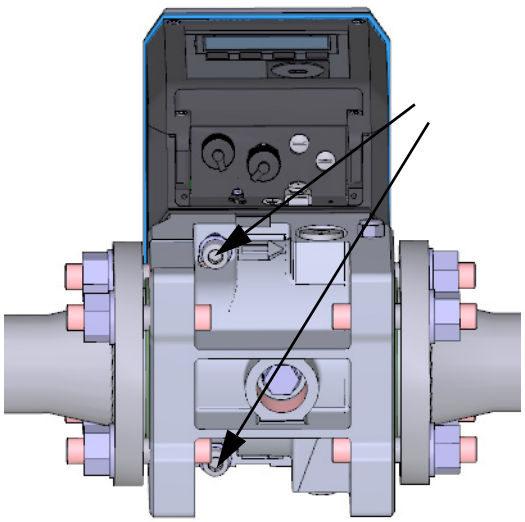
Meter size	Tightening torque [Nm]
DN50	45
DN80	100
DN100	145
DN150	



11 First screw the provided securing screws with Ripplock washers in manually.

12 Then tighten the securing screws with the Allen key to the specified tightening torque.

Meter size	Tighenting torque [Nm]
DN50	20
DN80	45
DN100	100
DN150	



13 Check the leak tightness, → p. 97, § 7.4.10.

14	After a successful leak tightness check, connect the replacement gas flow meter to the electric system, see §3. 4 “Electrical installation”.
15	If desired, upload the configuration of the previously installed gas flow meter to the replacement gas flow meter (→ p. 90, § 7.4.6).
16	Checking the function of the gas flow meter, → p. 99, § 7.4.11.
17	Securing metrologically, → p. 99, § 7.4.12, if necessary.

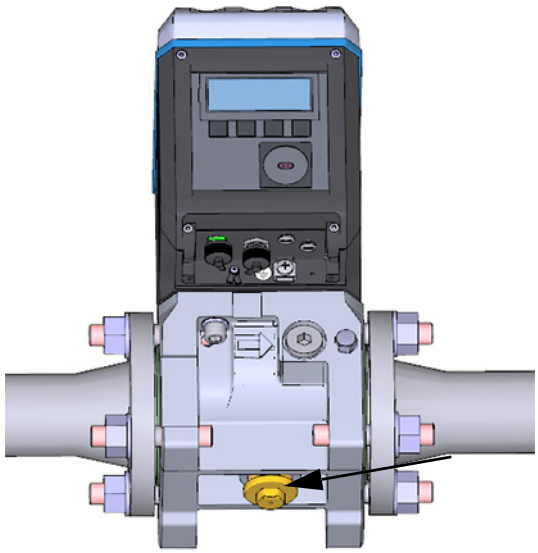
7.4.10 Performing a leak tightness check

After each replacement of the gas flow meter, the correct installation of the gas flow meter and the leak tightness of the measuring device has to be checked.

To check the leak tightness, the corresponding test cap for the respective meter size is needed (→ p. 88, § 7.4.4).

1 First screw the test cap for the respective meter size in manually.

2 Then tighten the test cap with the socket wrench until the test cap is completely screwed in.



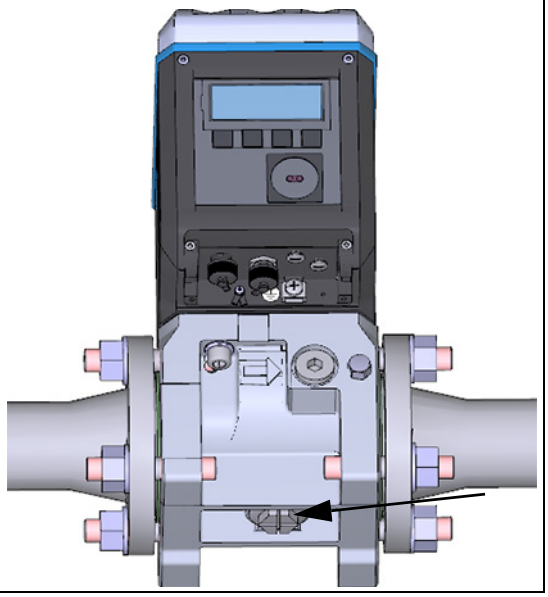
3 Slowly increase the pressure in the device (max. gradient 3 bar/min or 45 psi/min) up to the line pressure.

4 Apply leak detection spray to the opening of the test cap.

5 Check for at least 15 min. whether gas escapes from the opening of the test cap
- When no gas escapes from the opening of the test cap, see → p. 98, § 7.4.10.1
- When gas escapes from the opening of the test cap, see → p. 98, § 7.4.10.2.

7.4.10.1 Leak tightness check successful

1 Remove the test cap with the socket wrench.
2 Screw in the closure cap.
3 Then connect the replacement gas flow meter to the electric system, see §3. 4 “Electrical installation”.

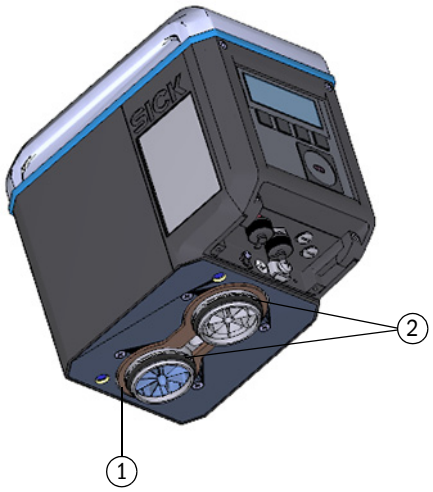


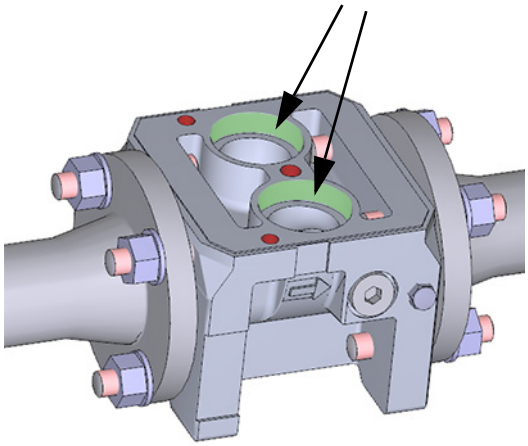
7.4.10.2 Leak tightness check not successful

1 Close the line and depressurize the device.
2 Vent the environment.
3 Remove the gas flow meter from the adapter as described, see → p. 91, § 7.4.8.

4 Check flat seal (1) and the O-rings on connections pieces (2) for completeness, intactness and correct installation. When the sealing elements are damaged, a new seal set is available as spare part.

Meter size	Item number
DN50	2076394
DN80	2076395
DN100	2076396
DN150	



5 Check the sealing surfaces on the adapter (marked green) for contamination and damage. 6 When the sealing surfaces are damaged, e.g. due to corrosion or external force, the adapter has to be exchanged.	
7 When the adapter is damaged, it has to be removed and a new adapter installed →p. 31, §3.3. Then install the gas flow meter anew, →p. 95, §7.4.9.	
8 When the components do not seem to be damaged but leak tightness can not be established, please contact SICK Customer Service (→p. 78, §6.1).	

7.4.11 Checking the function of the gas flow meter

- ► Record the diagnosis parameters (see Software Manual FLOWGate500, §11, “Field verification”).
- ► Check on the display if there are any malfunctions or warnings:

	Device status: Malfunction	The device has an error, the measured value is invalid.
	Device status: Warning	The device has a warning, the measured value is still valid.

- ► When malfunctions or warnings exist, clear the cause (→p. 77, §6).

7.4.12 Securing metrologically

- ► Gas flow meter and adapter can be secured at the joint by a user seal (adhesive label) (→p. 26, §2.10).
- ► When the parameter locking switch has been opened during the meter replacement, secure the parameter locking switch anew metrologically (→ Fig. 9, p. 27).

7.5 Function check of a pressure or temperature transmitter

The error status of a transmitter is displayed on the device as an event.

1 Switch to main display "Current events".

2 Check the list for a current event with type 'E-3010' (temperature transmitter failure) or 'E-3012' (pressure transmitter failure).

Exchange the transmitter involved when one of these errors is displayed → p. 100, § 7.6.

Replace the gas flow meter in the device configuration with internal pressure and temperature transmitters.

If an error is not displayed, the transmitter function can be checked by comparing the measured value on the FLOWSIC500 with the measured value of a reference transmitter.

7.6 Exchanging an external pressure or temperature transmitter

WARNING: Hazard through wrong spare parts

The FLOWSIC500 and the delivered pressure and temperature transmitters are designed intrinsically safe.

- Only pressure and temperature transmitters from SICK may be used → p. 106, § 8.2.2.
- The pressure and temperature transmitters can be connected and disconnected in the hazardous area as well.
- The pressure and temperature transmitters may only be connected using the M8 plug-in connectors marked accordingly on the FLOWSIC500.
- Modifying the electrical connection parts is not allowed.

NOTICE:

Pressure and temperature transmitters can only be exchanged when the parameter locking switch is open.

7.6.1 Exchanging the pressure transmitter

1 Three-way test valve: Move the knob to the test position (→ Table 14).

Kamstrup test valve: Fit the adapter on the test connection (part no. 2071841).

2 Unscrew the transmitter from the three-way test valve.

Here, loosen the screw fitting slowly so that any overpressure can escape under control.

3 Loosen the plug-in connector cover.

4 Disconnect the plug.

5 Connect the plug to the M8 connection on the FLOWSIC500.

6 Screw the plug-in connector cover tight.

7 Install a new pressure transmitter on the pressure measuring port marked “P_M” → p. 48, § 3.5.2.

8 Enter the serial number of the new transmitter in the FLOWSIC500 with the operating software FLOWgate500.

9 Check the function by comparing the operating point or checking the display value (remove adapter on test connection) against a reference measurement.

***NOTICE:* Leak tightness check**

SICK recommends a leak tightness check after transmitter replacement.

7.6.2 Exchanging the temperature transmitter

The temperature transmitter can be greased with heat-conductive oil or paste to improve its performance.

1 Loosen the locknut and pull the temperature transmitter out of the protective tube.
2 Loosen the plug-in connector cover.
3 Disconnect the plug.
4 Guide the plug of the new transmitter through the plug-in connector cover.
5 Connect the plug to the M8 connection on the FLOWSIC500.
6 Screw the plug-in connector cover tight.
7 Fit the new temperature transmitter in the protective tube → p. 52, § 3.5.3.
8 Enter the serial number of the new transmitter in the FLOWSIC500 with the operating software FLOWgate500.
9 Check the function by comparing the operating point or checking the display value (remove adapter on test connection) against a reference measurement.

FLOWSIC500

8 Accessories and Spare Parts

Accessories
Spare parts

8.1 Accessories

8.1.1 Gas flow meter accessories

Description	Part No.
Mounting set for meter installation 2"/DN50 with flange type ANSI150 (ASME B16.5)	2067402
Mounting set for meter installation 3"/DN50 with flange type ANSI150 (ASME B16.5)	2067403
Mounting set for meter installation 4"/DN50 with flange type ANSI150 (ASME B16.5)	2067404
Mounting set for meter installation 6"/DN50 with flange type ANSI150 (ASME B16.5)	2067405
Mounting set for meter installation 2"/DN50 with flange type PN16 (EN1092-1)	2067406
Mounting set for meter installation 3"/DN50 with flange type PN16 (EN1092-1)	2067407
Mounting set for meter installation 4"/DN50 with flange type PN16 (EN1092-1)	2067408
Mounting set for meter installation 6"/DN50 with flange type PN16 (EN1092-1)	2067409
Dummy plug for pressure connection NPT 1/4"	2067398
Dummy plug for temperature connection G1/2"	2067401
M12 plug (A-coded) for data transfer	2067419
M12 connector (B-coded) for power supply	2067420
2 m connection cable for data transfer; -25 °C ... +60 °C / -13 °F ... +140 °F; with connector (A-coded) and ferrules	2067422
5 m connection cable for data transfer; -25 °C ... +60 °C / -13 °F ... +140 °F; with connector (A-coded) and ferrules	2067423
2 m connection cable for data transfer; -40 °C ... +70 °C / -40 °F ... +158 °F; with connector (A-coded) and ferrules	2067630
5 m connection cable for data transfer; -40 °C ... +70 °C / -40 °F ... +158 °F; with connector (A-coded) and ferrules	2067631
10 m connection cable for power supply; -25 °C ... +60 °C/ -13 °F ... +140 °F; with connector (B-coded) and ferrules	2067424
20 m connection cable for power supply; -25 °C ... +60 °C/ -13 °F ... +140 °F; with connector (B-coded) and ferrules	2067425
10 m connection cable for power supply; -40 °C ... +70 °C/ -40 °F ... +158 °F; with connector (B-coded) and ferrules	2067632
20 m connection cable for electrical supply; -40 °C ... +70 °C/ -40 °F ... +158 °F; with plug (B-coded) and connector sleeves	2067633
Intrinsically safe power supply JBZ-02; input voltage 10.5... 15V, nominal 12V; ATEX II(2)G [EX ib] IIC; DIN rail mounting; degree of protection IP20; operating temperature: -25°C... +60°C	6050601
Single-channel safety barrier series 9001; operating voltage 12 V DC; ATEX II 3 (1) G Ex nA [ia Ga] IIC/IIB T4 Gc; CSA Class I, Division 2, Groups A, B, C, D; degree of protection IP20/40; operating temperature -20 °C ... +60 °C	6050603
Power supply unit 253 V AC / 12 V DC; operating voltage 12 V DC/1 A; 1-phase; screw connection; DIN rail mounting NS 35, EN 60715; CUL listed; degree of protection IP20; operating temperature: -25 °C ... 70 °C	6050642
Infrared/USB adapter HIE-04; data transfer up to 38400 baud; USB 2.0; cable length 2.25 m; ATEX II 2G Ex mb IIC T4; operating temperature -25 °C ... +60 °C; degree of protection IP30	6050602
Screw-in protective tube set, G1/2 082 -40°C	2068735
Tamper-proof protection of connectors	2067397
Elgas midiDatcom: Battery powered Data Logger with integrated GSM/GPRS modem; ATEX II 1G Ex ia IIA T3 Ga; Battery lifetime > 5 years	6058324

8.1.2 Volume conversion (device option) accessories

Description	Part No.
Pressure connection set, -40 °C to 70 °C: Three-way cock, fitting with ferrule 6 mm, test connection (Minimess coupling)	2066281
Pressure connection set, -40°C to 70°C: Three-way cock, fitting with ferrule 1/4", test connection (Minimess coupling)	2071770
Pressure connection set, -25°C to 60°C: Kamstrup test valve BDA04 (G1/4"), fitting with ferrule	2071098
Hose connection set DN4 RP1/4	2071841
Thermowell, gasket for use in -40°C to 70°C	2068309

8.1.3 Transport accessories

Description	Part No.
Transport protection for gas flow meter, rated width DN50/2"	2079021
Transport protection for gas flow meter, rated width DN80/3	2079001
Transport protection for gas flow meter, rated width DN100/4"	2079022
Transport protection for gas flow meter, rated width DN150/6"	

8.2 Spare parts

8.2.1 Gas flow meter spare parts

Description	Part No.
Battery (7.2 V; 19 Ah) for self-sufficient meter operation	2064018
Backup battery (7.2 V; 2.7 Ah) for intrinsically safe main power supply	2065928
Display module	2066077
Gas flow meter replacement set for 2"/DN50	2067510
Gas flow meter replacement set for 3"/DN80	2067511
Gas flow meter replacement set for 4"/DN100 and 6"/DN150	2067512
Gasket set for gas flow meter replacement 2"/DN50	2067394
Gasket set for gas flow meter replacement 3"/DN80	2067395
Gasket set for gas flow meter replacement 4"/DN100 + 6"/DN150	2067396

8.2.2 Volume conversion (device option) spare parts

Description	Part No.
EDT23 - digital pressure transmitter; overpressure 0 to 4 bar	2071175
EDT23 - digital pressure transmitter; overpressure 0 to 10 bar	2071174
EDT23 - digital pressure transmitter; overpressure 0 to 20 bar	2071176
EDT23 - digital pressure transmitter; absolute pressure 0.8 to 5.2 bar	2071178
EDT23 - digital pressure transmitter; absolute pressure 2 to 10 bar	2071179
EDT23 - digital pressure transmitter; absolute pressure 4 to 20 bar	2071180
EDT34 - digital temperature transmitter, -25 °C to +60 °C	2071181
EDT34 - digital temperature transmitter, -40 °C to +70 °C	2071777
Sealing plug NPT 1/4"	2067398
Sealing plug G1/4"	2067400
Pipe screw fitting for pipe diameter 6 mm	2071771
Pipe screw fitting for pipe diameter 1/4"	2069071
Adapter from G1/4" to NPT 1/4"	2072456

FLOWSIC500

9 Annex

Conformities and Technical Data
Dimensional drawings
Type plates
Type code
Internal terminal assignment
Installation examples

9.1 Conformities and Technical Data

9.1.1 CE certificate

The FLOWSIC500 has been developed, manufactured and tested in accordance with the following EU Directives:

- Pressure Equipment Directive 97/23/EC
- Directive 94/9/EC (ATEX)
- EMC Directive 2004/108/EC
- Measuring Instruments Directive 2004/22/EC

Conformity with the above Directives has been determined and the CE label attached to the device.

9.1.2 Standards compatibility

The FLOWSIC500 conforms to the following standards or recommendations:

- OIML R137-1&2, 2012

  Gas Meters - Part 1: Metrological And Technical Requirements; Part 2: Metrological Controls And Performance Tests
- EN 60079-0:2012/A11:2013, EN 60079-11:2012, EN 60079-28:2007

  Explosive atmospheres - Part 0: Equipment - General requirements; Part 11: Equipment protection by intrinsic safety "i"; Part 28: Protection of equipment and transmission systems using optical radiation
- IEC 60079-0: 2011, IEC 60079-28: 2011 (6th Edition)

  Explosive atmospheres - Part 0: Equipment - General requirements; Part 28: Protection of equipment and transmission systems using optical radiation
- IEC 60079-11: 2011+Cor.: 2012 (6th Edition)

  Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
- EN 61326-1:2006

  Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2005)
- IEC 61326:2005

  Electrical equipment for measurement, control and laboratory use – EMC requirements
- EN 61010-1:2010

  Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements (IEC 61010-1:2010)
- IEC 61010-1:2010 + Cor.: 2011

  Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
- EN 12405-1+A2:2010-10

  Gas meters - Conversion devices - Part 1: Volume conversion

9.1.3 Technical Data

Meter characteristics and measuring parameters		
Measured variable	Volume a.c., volume flow a.c.	
Measuring principle	Ultrasonic transit time difference measurement	
Measured medium	Natural gas (dry, odorized), nitrogen, air	
Measuring ranges	Volume flow a.c., DN 50	1.0 ... 160 m^3/h (46 ... 5,650 cfh)
	Volume flow a.c., DN 80	2.5 ... 400 m^3/h (88 ... 14,125 cfh)
	Volume flow a.c., DN 100	4 ... 650 m^3/h (141 ... 22,955 cfh)
	Volume flow a.c., DN 150	4 ... 1,000 m^3/h (141 ... 35,314 cfh)
Repeatability	≤ 0.1%	
Accuracy	Accuracy class1, typical error limits Q_{min} up to 0.1 Q_{max}: ≤ ± 1.0% 0.1 Q_{max} up to Q_{max}: ≤ ± 0.5%	
	Accuracy class 1, maximum allowed error limits: Q_{min} up to 0.1 Q_{max}: ≤ ± 2% 0.1 Q_{max} up to Q_{max}: ≤ ± 1% After HP flow calibration: ± 0.2% with test pressure, otherwise ± 0.5%	
Diagnostics functions	Permanent monitoring of measured values	
Gas temperature	-25 °C ... +60 °C (-13 °F ... 140 °F); optional: -40 °C ... +70 °C (-40 °F ... 158 °F)	
Operating pressure	PN16 (EN 1092-1, GOST 12815-80): 0 bar (g) ... 16 bar (g) Class 150 (ASME B16.5): 0 bar (g) ... 20 bar (g)	
Ambient conditions		
Ambient temperature	-25 °C ... +60 °C (-13 °F ... 140 °F); optional: -40 °C ... +70 °C (-40 °F ... 158 °F)	
Storage temperature	-40 °C ... +80 °C (-40 °F ... 176 °F)	
Electromagnetic Conditions (EMC)	E2 in accordance with OIML R137-1&2, 2012	
Mechanical conditions	M2 in accordance with OIML R137-1&2, 2012	
Approvals		
Conformities	→ p. 108, § 9.1	
Ex approvals	IECEx	Ex ia [ia] IIB T4 Gb, Ex ia [ia] IIC T4 Gb, Ex op is IIC T4 Gb
	ATEX	II 2G Ex ia [ia] IIB T4 Gb, II 2G Ex ia [ia] IIC T4 Gb, II 2G Ex op is IIC T4 Gb
	NEC/CEC (US/CA)	CSA: I. S. for Class I, Division 1 Groups C,D T4, Ex/AEx ia IIB T4 Ga
IP classification	IP 66	
Outputs and interfaces		
Digital outputs	Configurations: ● LF pulses + malfunction, electrically isolated (f_{max} = 100 Hz) ● HF pulses + malfunction, electrically isolated (f_{max} = 2 kHz) ● Encoder + LF pulses, electrically isolated (f_{max} = 100 Hz) ● Encoder + HF pulses, not electrically isolated (f_{max} = 2 kHz)	
Interfaces	● RS-485 module (externally powered) *alternative* to digital outputs, Modbus RTU protocol ● Optical interface (according to EN62056-21 (Section 4.3)	
Installation		
Dimensions (W x H x D)	See dimensional drawings (→ p. 117, § 9.4)	
Weight	See dimensional drawings (→ p. 117, § 9.4)	
Material in contact with media	Aluminium AC-42100-S-T6	
Mounting	Horizontal or vertical installation with 0 D straight inlet/outlet piping	

Electrical connection	
Voltage	Intrinsically safe supply: 4.5 ... 16 V DC
	Including 3-months backup battery
Power input	≤ 100 mW
General	
Options	Self-sufficient meter design (typical battery service life: More than 5 years)
Scope of delivery	The scope of delivery is dependent on the application and the customer specification.

Table 27 Technical Data (additional for device option volume conversion)

Volume conversion		
Accuracy	Accuracy class 0.5 Maximum allowed error limit of conversion factor C: ≤ ± 0.5% (at reference conditions)	
Conversion method	PTZ or TZ	
Calculation methods	● SGERG88, ● AGA 8 Gross method 1 ● AGA 8 Gross method 2 ● AGA NX-19	● AGA NX-19 mod. ● AGA NX-19 mod. GOST ● GERG91 mod. ● Fixed value
Logbooks and Archives		
Logbooks	● Event logbook (1000 entries) ● Parameter logbook (250 entries) ● Metrology logbook (100 entries)	
Archives	● Billing archive (6000 entries) ● Day archive (600 entries) ● Month archive (25 entries)	
Pressure transmitter (only for device option volume conversion)		
Measuring ranges	Absolute pressure transmitters	Relative pressure transmitters
	0.8 ... 5.2 bar (a)	0 ... 4 bar (g)
	2.0 ... 10.0 bar (a)	0 ... 10 bar (g)
	4.0 ... 20.0 bar (a)	0 ... 20 bar (g)
Temperature transmitter (only for device option volume conversion)		
Measuring ranges	-25 ... +60 ° C	
	-40 ... +70 ° C (optional)	

9.1.4 Flow rates

Table 28 Flow rates

Meter size	G class	Measuring range [m³/h]	Measuring range [cfh]	Turndown ratio
DN50 / 2"	G 40	1.3 - 65	45.9 - 2,295.5	1 : 50
	G 65	2.0 - 100	70.6 - 3,530.5	1 : 50
	G 100	3.2 - 160	113.0 - 5,650.3	1 : 50
	G 100	1.6 - 160	56.5 - 5,650.3	1 : 100
	G 100	1.0 - 160	35.3 - 5,650.0	1 : 160
DN80 / 3"	G 100	3.2 - 160	113.0 - 5,650.0	1 : 50
	G 160	5.0 - 250	176.6 - 8,828.7	1 : 50
	G 160	2.5 - 250	88.3 - 8,828.7	1 : 100
	G 250	8.0 - 400	282.5 - 14,125.9	1 : 50
	G 250	4.0 - 400	141.3 - 14,125.9	1 : 100
	G 250	2.5 - 400	88.3 - 14,125.9	1 : 160
DN100 / 4"	G 160	5.0 - 250	176.6 - 8,828.7	1 : 50
	G 250	8.0 - 400	282.5 - 14,125.9	1 : 50
	G 250	4.0 - 400	141.3 - 14,125.9	1 : 100
	G 400	13.0 - 650	459.1 - 22,954.5	1 : 50
	G 400	6.5 - 650	229.5 - 22,954.5	1 : 100
	G 400	4.0 - 650	141.3 - 22,954.5	1 : 160
DN150 / 6"	G 250	8.0 - 400	282.5 - 14,125.9	1 : 50
	G 250	4.0 - 400	141.3 - 14,125.9	1 : 100
	G 400	13.0 - 650	459.1 - 22,954.5	1 : 50
	G 400	6.5 - 650	229.5 - 22,954.5	1 : 100
	G 400	4.0 - 650	141.3 - 22,954.5	1 : 160
	G 650	20.0 - 1000	706.3 - 35,314.7	1 : 50
	G 650	10.0 - 1000	353.1 - 35,314.7	1 : 100
	G 650	6.2 - 1000	219.0 - 35,314.7	1 : 160
	G 650	5.0 - 1000	176.6 - 35,314.7	1 : 200
	G 650	4.0 - 1000	141.3 35,314.7	1 : 250

9.1.5 Overload protection

Table 29 Overload protection

Meter size	Q_{max}		Overload protection		
	[m³/h]	[cfh]		[m³/h]	[cfh]
DN50 / 2"	160	5,650	150 % Q_{max}	240	8,475
DN80 / 3"	400	14,125	150 % Q_{max}	600	21,187.5
DN100 / 4"	650	22,955	150 % Q_{max}	975	34,432.5
DN150 / 6"	1000	35,314	120 % Q_{max}	1200	42,376.8

9.2 Type code

Fig. 38 Type code (overview)

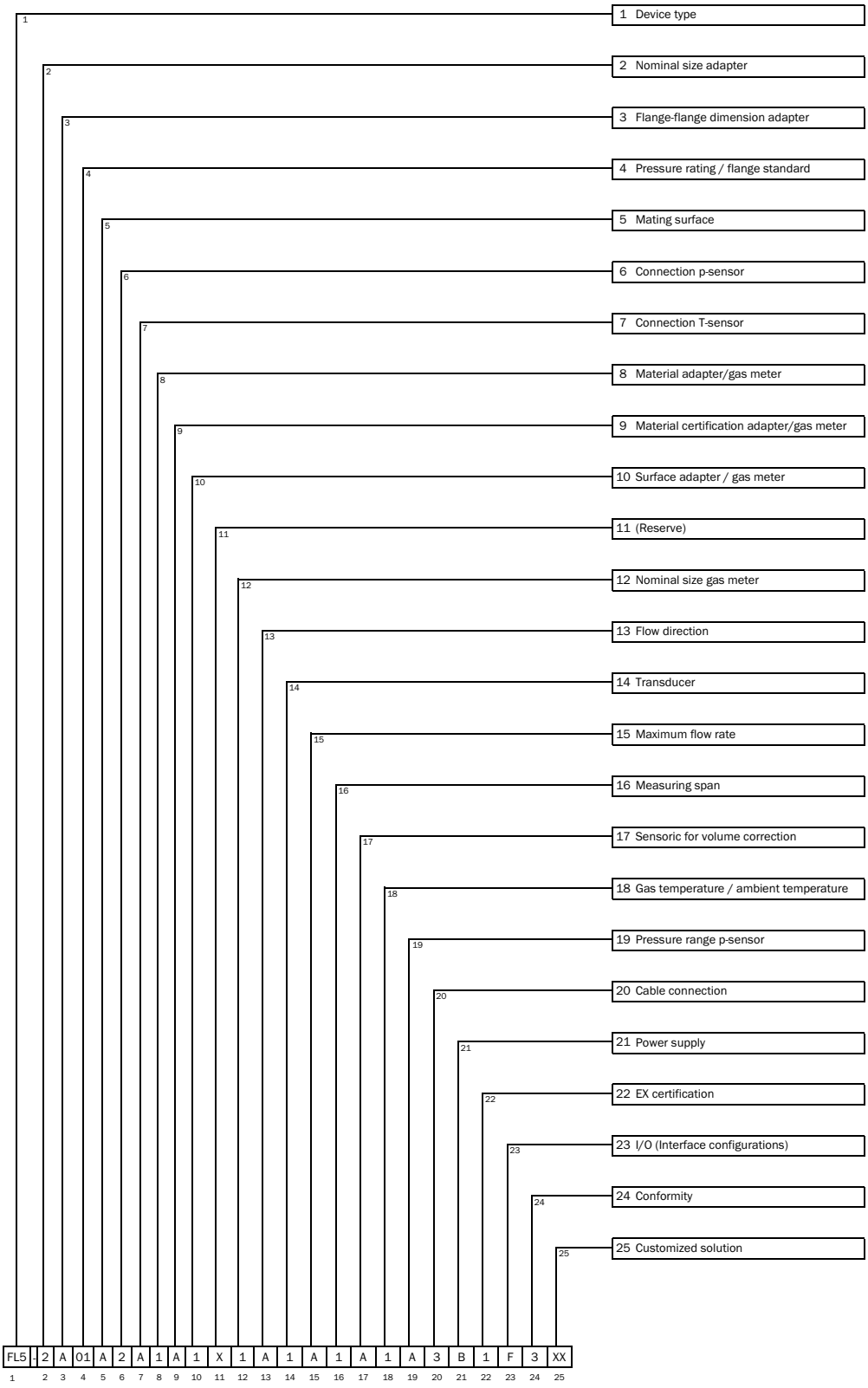


Fig. 39 Type code (explanation)

1	**Device type**	
	FL5	FLOWSIC500
2	**Nominal size adapter**	
	X	Replacement meter only
	1	DN 50 / 2"
	2	DN 80 / 3"
	3	DN100 / 4"
	D	DN150 / 6", adapter 4"
3	**Flange-flange dimension adapter**	
	X	Replacement meter only
	A	50 mm
	B	171 mm
	E	241 mm
	G	300 mm
	L	450 mm
4	**Pressure rating / flange standard**	
	01	PN16 / EN1092-1
	02	Class 150 / ASME B16.5
	03	PN16 / GOST 12815-80
5	**Mating surface**	
	X	Replacement meter only
	A	Flat face, smooth finish
	B	Raised face, smooth finish
	C	Form A / DIN EN 1092-1
	D	Form B1 / DIN EN 1092-1
6	**Connection p-sensor**	
	X	Replacement meter only
	1	Plug NPT 1/4"
	2	Plug G1/4"
	3	Compression fitting 1/4"
	4	Compression fitting D6
7	**Connection T-sensor**	
	X	Replacement meter only
	A	without
8	**Material adapter/gas meter**	
	1	Aluminum / aluminum
9	**Material certification adapter/gas meter**	
	A	3.1 / 3.1
10	**Surface adapter/gas meter**	
	1	Shot-peened / SICK standard
11	**Reserve**	
	X	-
12	**Nominal size gas meter**	
	1	DN 50 / 2"
	2	DN 80 / 3"
	3	DN100 / 4"
	C	DN150 / 6"
13	**Flow direction**	
	A	Left - right
	B	Right - left
14	**Transducer**	
	1	Type 1: 300 kHz
15	**Maximum flow rate**	
	A	Qmax 65 m³/h
	B	Qmax 100 m³/h
	C	Qmax 160 m³/h
	D	Qmax 250 m³/h
	E	Qmax 400 m³/h
	F	Qmax 650 m³/h
	G	Qmax 1000 m³/h
16	**Measuring span**	
	1	1:50
	2	1:100
	3	1:160
	4	1:200
	9	1:250

17	**Sensoric for volume correction**	
	A	-
	B	T-Sensor external
	C	T-Sensor internal
	D	p/T-Sensoren external
	E	p/T-Sensoren internal
18	**Gas temperature/ambient temperature**	
	1	-25 °C ... +60 °C / -25 °C ... +60 °C
	3	-40 °C ... +70 °C / -40 °C ... +70 °C
19	**Pressure range p-Sensor**	
	A	-
	B	absolute 0,8 ... 5,2 bar
	C	absolute 2,0 ... 10,0 bar
	D	absolute 4,0 ... 20,0 bar
	F	relative 0 ... 4,0 bar / 0 ... 58,0 PSI
	G	relative 0 ... 10,0 bar / 0 ... 145,0 PSI
	H	relative 0 ... 25,0 bar / 0 ... 362,6 PSI
20	**Cable connection**	
	1	2x M12 , 2x M8
	3	2x M12
21	**Power supply**	
	B	External with backup battery
	C	Autarkic with battery pack (5 years)
22	**EX certification**	
	1	ATEX Zone 1 / IEC-Ex Zone 1, Group IIB
	2	ATEX Zone 1 / IEC-Ex Zone 1, Group IIC
	3	CSA Class 1 Div 1, Group CD
	N	without
23	**I/O (Interface configurations)**	
	A	Impulse LF + Status (not galvanically isolated)
	B	Impulse HF (galvanically isolated)
	C	Encoder
	D	RS485 (externally powered)
	E	Encoder + Impulse (not galvanically isolated)
	F	Impulse LF + Status (galvanically isolated)
	G	Impulse HF + Status (galvanically isolated)
	H	Encoder + Impulse LF (galvanically isolated)
	I	RS485 Modul - battery powered (external)
	J	RS485 Modul - line powered (external)
	K	Encoder + Impulse HF (not galvanically isolated)
24	**Conformity**	
	2	PED
	3	MID, PED
	4	PED, CIS
25	**Customized solution**	
	XX	-

9.3 Type plates

9.3.1 Metrology and electronics type plates

Fig. 40 Legend for type plates

Variable	Bezeichnung	Description
00	Typschlüssel	Type code
01	Artikelnummer Gaszähler (Materialnr.)	Part number gas meter (material number)
02	Seriennummer	Serial number
02.1	Seriennummer (XXXX XXXX)	Serial number (XXXX XXXX)
03	Datum (MM/JJJJ)	date (MM/YYYY)
04	Min. Umgebungstemperatur	Min. ambient temperature
05	Max Umgebungstemperatur	Max. ambient temperature
06	Min. Mediumstemperatur	Min. gas temperature
07	Max. Mediumstemperatur	Max. gas temperature
08	Max. Durchfluss	Max. flow rate
09	Min. Durchfluss	Min. flow rate
10	Trenndurchfluss	Transition flow rate
11	Nennweite	Size
12	Jahr (metrologisch) (JJ)	Year (metrological) (YY)
13	Datamatrix-Code 01(M)+02(S) Format: MMMMMMMSSSSSSSS	Datamatrix-Code 01(M)+02(S) Format: MMMMMMMSSSSSSSS
13.1	Datamatrix-Code 01(M)+7SIC00+02(S) Format: MMMMMM7SIC00SSSSSSS	Datamatrix-Code 01(M)+7SIC00+02(S) Format: MMMMMM7SIC00SSSSSSS
16	Belegung PIN 1_1	PIN assignment 1_1
17	Belegung PIN 1_2	PIN assignment 1_2
18	Belegung PIN 2_1	PIN assignment 2_1
19	Belegung PIN 2_2	PIN assignment 2_2
20	Belegung PIN 2_3	PIN assignment 2_3
21	Belegung PIN 2_4	PIN assignment 2_4
22	Platzhalter Angaben EVCD	Placeholder label EVCD
23	Platzhalter Angaben CE	Placeholder label CE
24	Platzhalter variable Kennzeichnung	Placeholder variable sign
25	Durchmesser - 7/8*DNXX	diameter - 7/8*DNXX
26	Gewicht Gaszähler	Weight gas meter
30	Einheit der Temperatur (04)/(05)/(06)/(07)	unit of temperature (04)/(05)/(06)/(07)
31	Einheit des Volumenstroms (08)/(09)/(10)	unit of volume flow (08)/(09)/(10)
32	Einheit der Länge (25)	unit of lenght (25)
33	Einheit des Gewichts (26)	unit of weight (26)

9.3.1.1 Labelling according to ATEX/IECEx

Fig. 41 Metrology and electronics type plate (example))

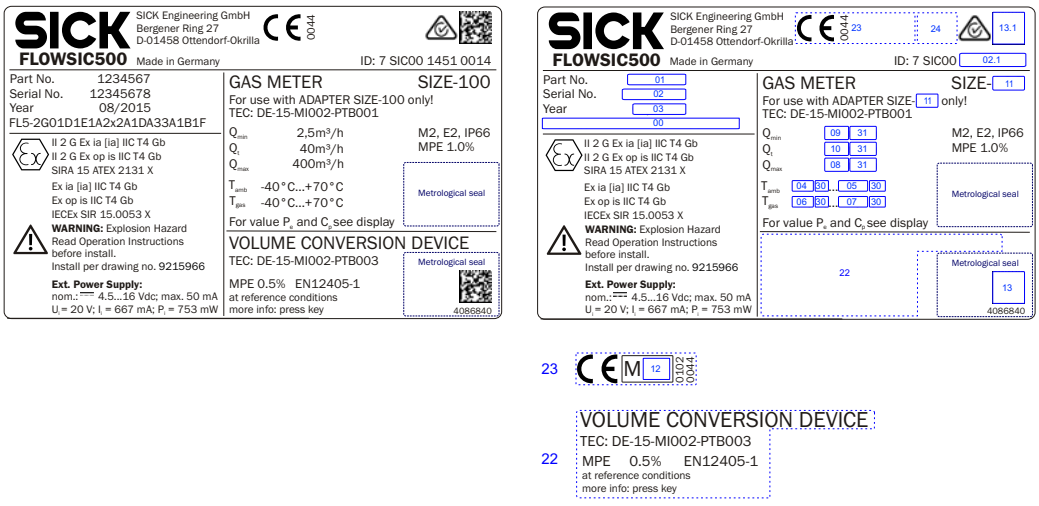
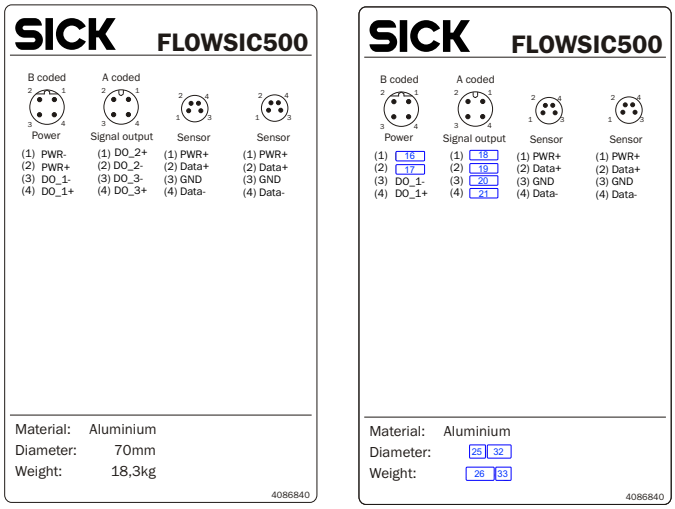


Fig. 42 Pin assignment of plug-in connectors



9.3.1.2 Labelling according to CSA

Fig. 43 Metrology type plate (example)

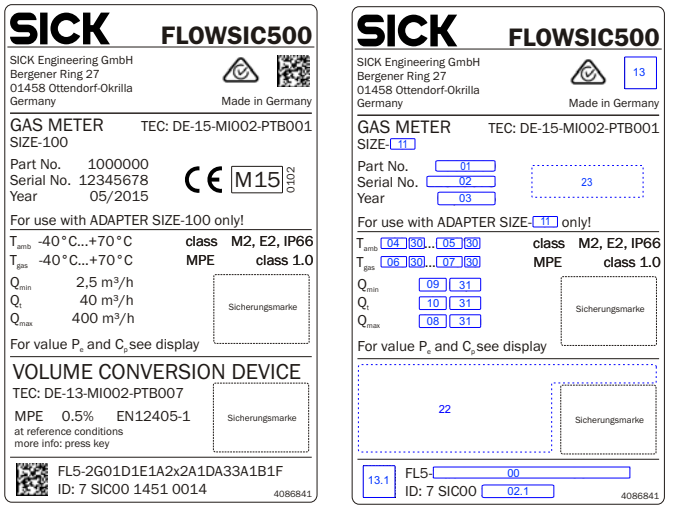
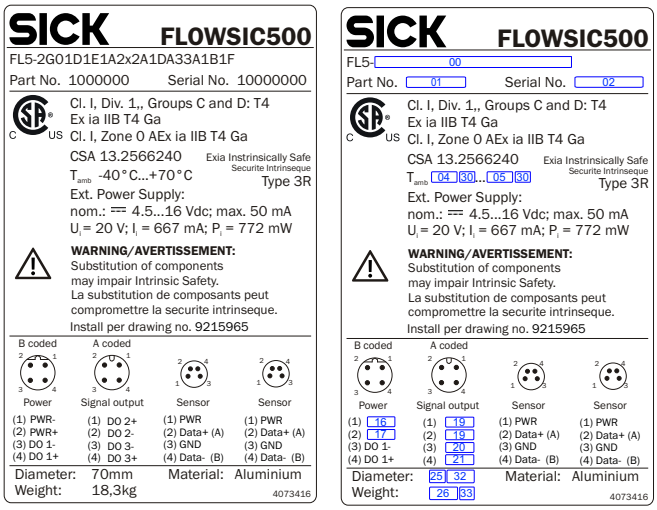
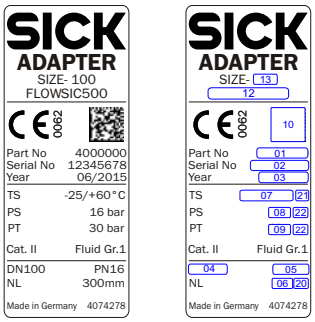


Fig. 44 Electronics type plate (example)



9.3.2 PED type plate

Fig. 45 PED type plate (example)



Variable	Bezeichnung	Description
01	Artikelnummer (Adapter)	Part number (Adapter)
02	Seriennummer (SSSSSSSS) (Adapter)	Serial number (SSSSSSSS) (Adapter)
03	Datum (MM/YYYY)	Date (MM/YYYY)
04	Nennweite Adapter	Adapter size
05	Druckstufe	Pressure rating
06	Nennlänge	Flange to flange dimension
07	Einsatztemperaturbereich (Format: -min/+max)	Temperature range (format: -min/+max)
08	Max. Betriebsüberdruck	Max. operating overpressure
09	Prüfüberdruck	Pressure
10	Datamatrix-Code 01(M) + 02(S Format: MMMMMMMSSSSSSSS	Datamatrix-Code 01(M) + 02(S) Format: MMMMMMMSSSSSSSS
11	Jahr (metrologisch) (YY)	Year (Metrological) (YY)
12	Label Gerätetyp (FLOWSIC500 oder FLOWSIC500 CIS)	Label device type(FLOWSIC500 or FLOWSIC500 CIS)
13	Nennweite	Size
20	Einheit zur Nennlänge 08	Unit of nominal length 08
21	Einheit zur Temperatur 09	Unit of temperature 09
22	Einheit zum Druck 10 & 11	Unit of pressure 10 & 11

9.4 Dimensional drawings

Fig. 46 Dimensions

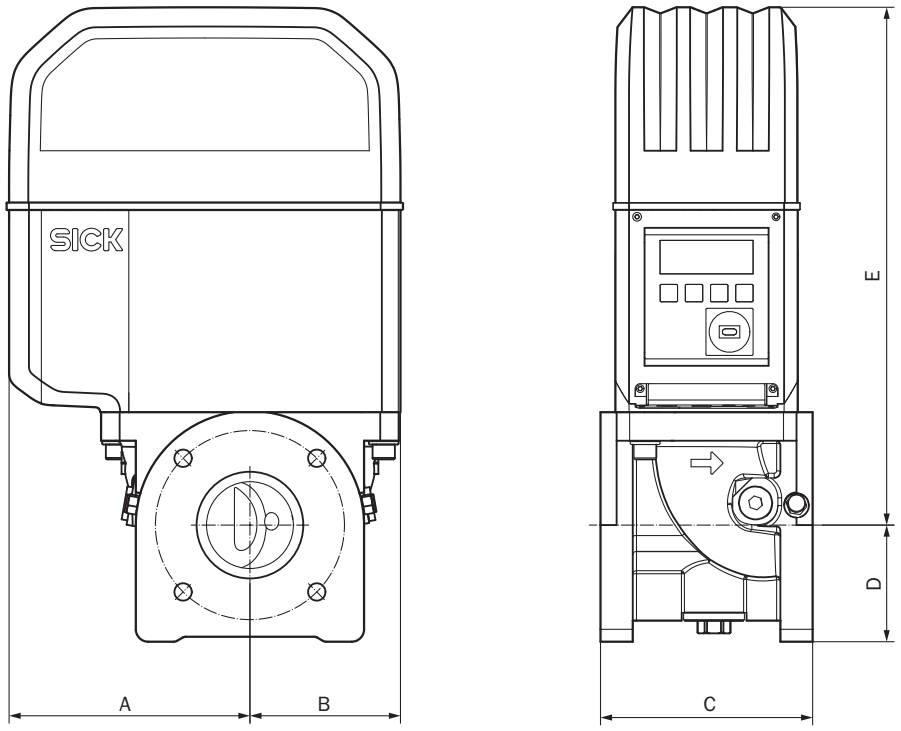


Table 30 Dimensions metrical (imperial)[1]

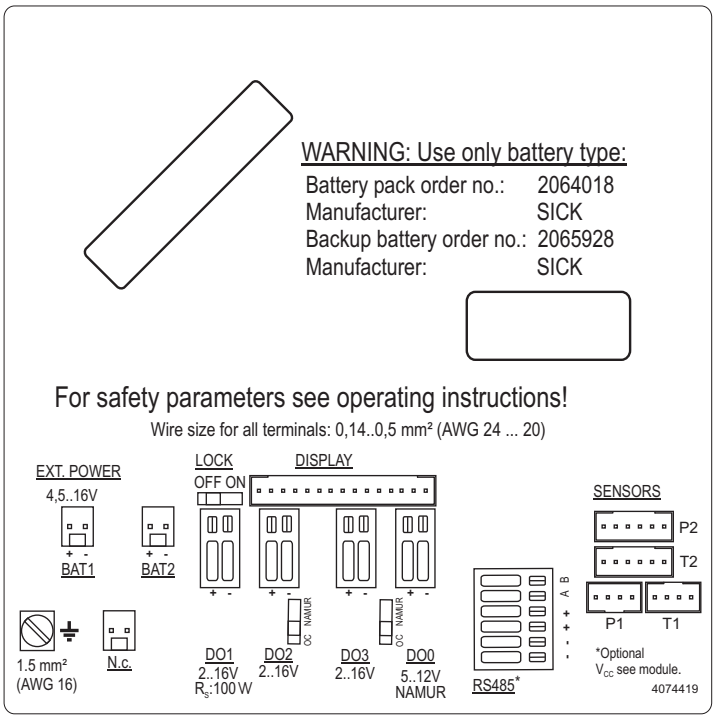
	DN50 (2")		DN80 (3")		DN100 (4")		DN150 (6")
A	153 (6.02)		194 (7.64)		231 (9.09)		232 (9.13)
B	78 (3.07)		121 (4.76)		159 (6.26)		158 (6.22)
C[2]	150 (5.91)	171 (6.73)	171 (6.73)	241 (9.49)	241 (9.49)	300 (11.81)	450 (17.72)
D	71 (2.80)		94 3.70)		108 (4.25)		143 (5.63)
E	272 (10.71)		417 (16.42)		476 (18.74)		476 (18.74)
Weight	11 (24.25)	11 (24.25)	19 (42)	21 (46.3)	28 (61.7)	30 (66.1)	35 (77.1)

[1] All dimensions in mm (inch), weights in kg (lb)

[2] C = fitting length, two fitting lengths are available for meter sizes DN50 (2") to DN100 (4").

9.5 Internal terminal assignment

Fig. 47 Terminal assignment



9.6 Installation examples

Fig. 48 Battery operation

FLOWSIC500 with LF output connected to electronic volume corrector
(both battery powered and intrinsically safe)

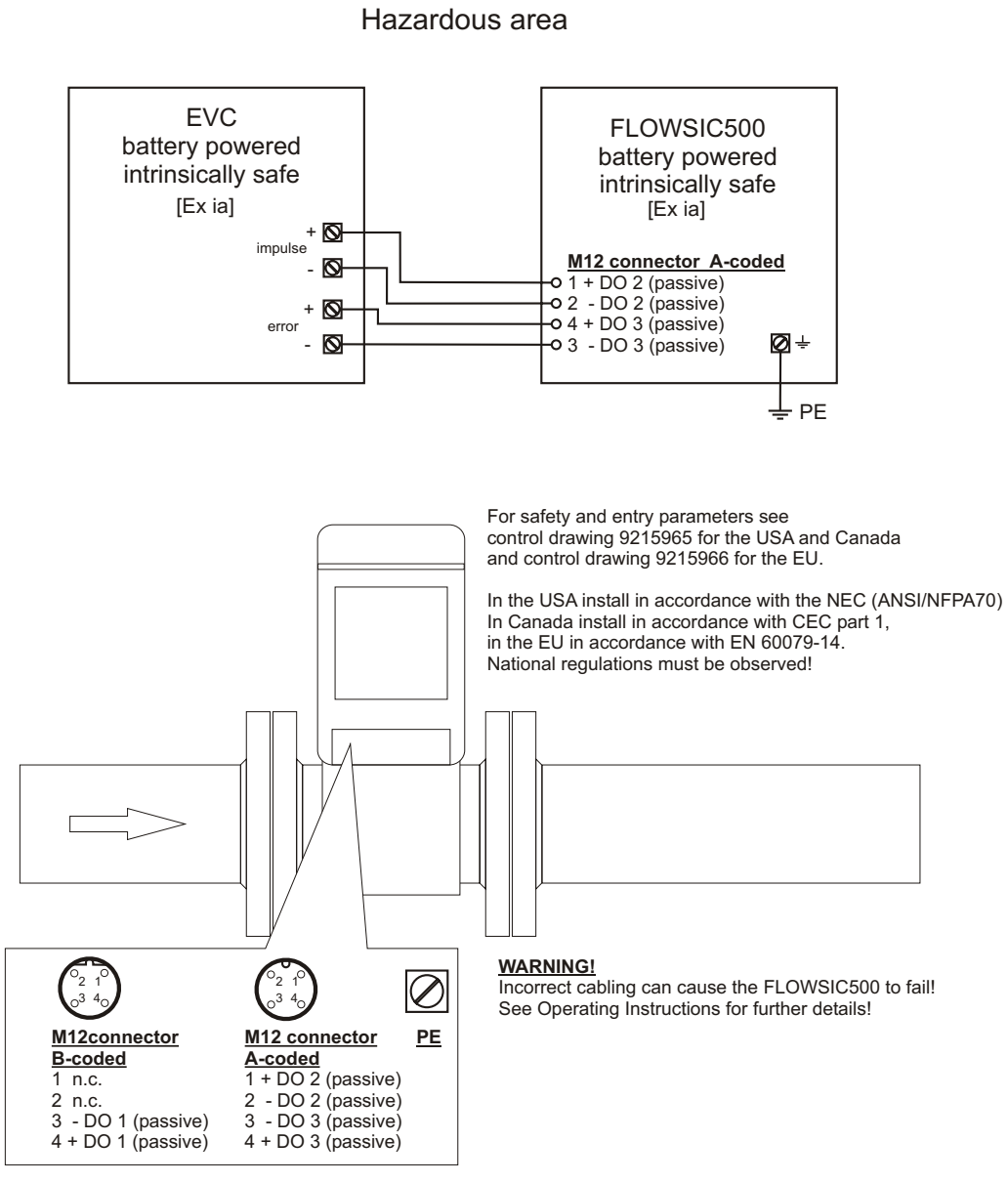
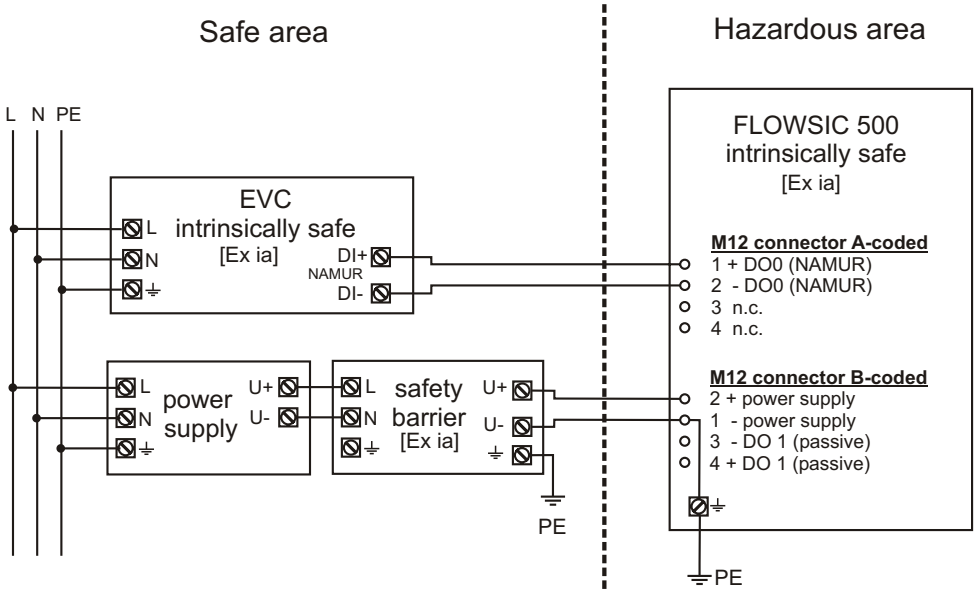
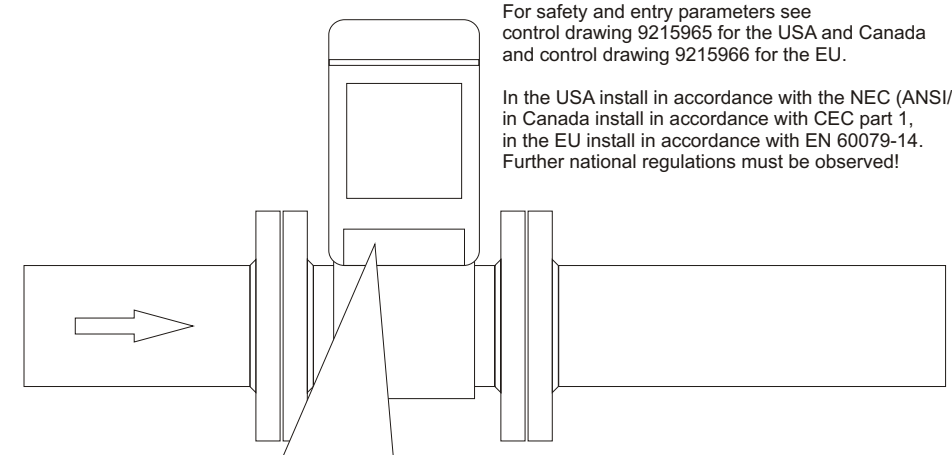


Fig. 49 Operation with safety barrier and external power supply

FLOWSIC500 with HF output powered with safety barrier and external power supply, connected to electronic volume corrector





For safety and entry parameters see control drawing 9215965 for the USA and Canada and control drawing 9215966 for the EU.

In the USA install in accordance with the NEC (ANSI/NFPA70), in Canada install in accordance with CEC part 1, in the EU install in accordance with EN 60079-14. Further national regulations must be observed!

M12connector B-coded
1 - power supply
2 + power supply
3 - DO 1 (passive)
4 + DO 1 (passive)

M12connector A-coded
1 + DO0 (NAMUR)
2 - DO0 (NAMUR)
3 n.c.
4 n.c.

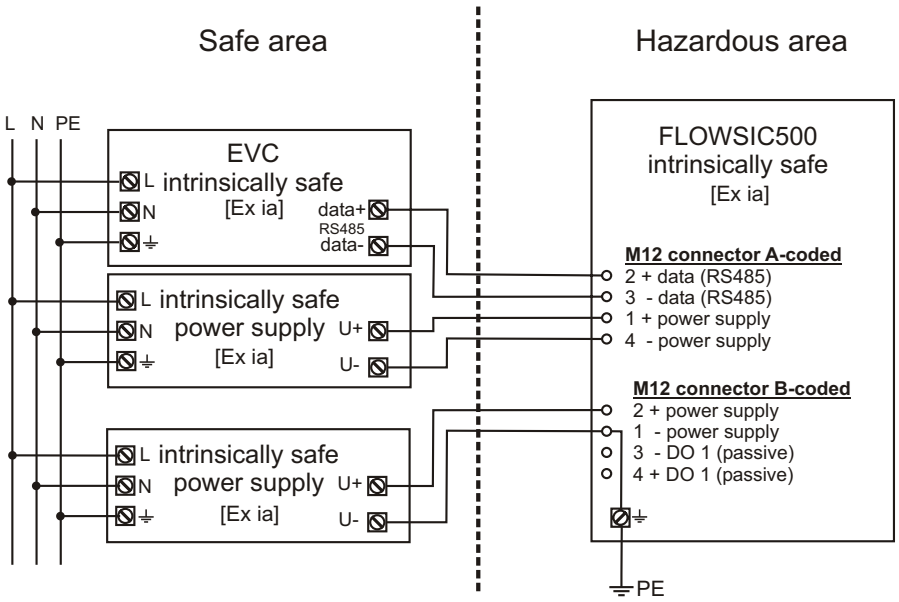
PE

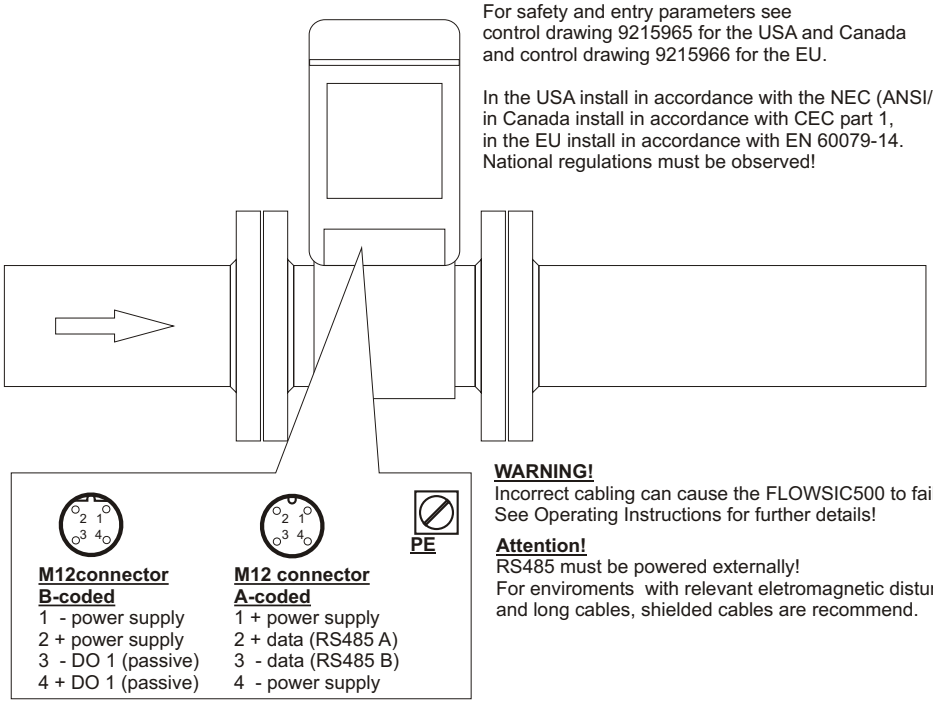
WARNING!
Incorrect cabling can cause the FLOWSIC500 to fail!
See Operating Instructions for further details!

Attention!
DO0 is optically insulated.
Do not use as HF output in battery powered mode!
Frequent activity results in a reduced battery life time.

Fig. 50 Operation with external power supply (intrinsically safe)

FLOWSIC500 externally powered (IS) and connected to electronic volume corrector, RS485 externally powered





For safety and entry parameters see control drawing 9215965 for the USA and Canada and control drawing 9215966 for the EU.

In the USA install in accordance with the NEC (ANSI/NFPA70), in Canada install in accordance with CEC part 1, in the EU install in accordance with EN 60079-14. National regulations must be observed!

WARNING!
Incorrect cabling can cause the FLOWSIC500 to fail!
See Operating Instructions for further details!

Attention!
RS485 must be powered externally!
For enviroments with relevant eletromagnetic disturbance and long cables, shielded cables are recommend.

9.7 Connection diagrams for operation of the FLOWSIC500 in accordance with CSA

Fig. 51 Control diagram 9215965 (page 1)

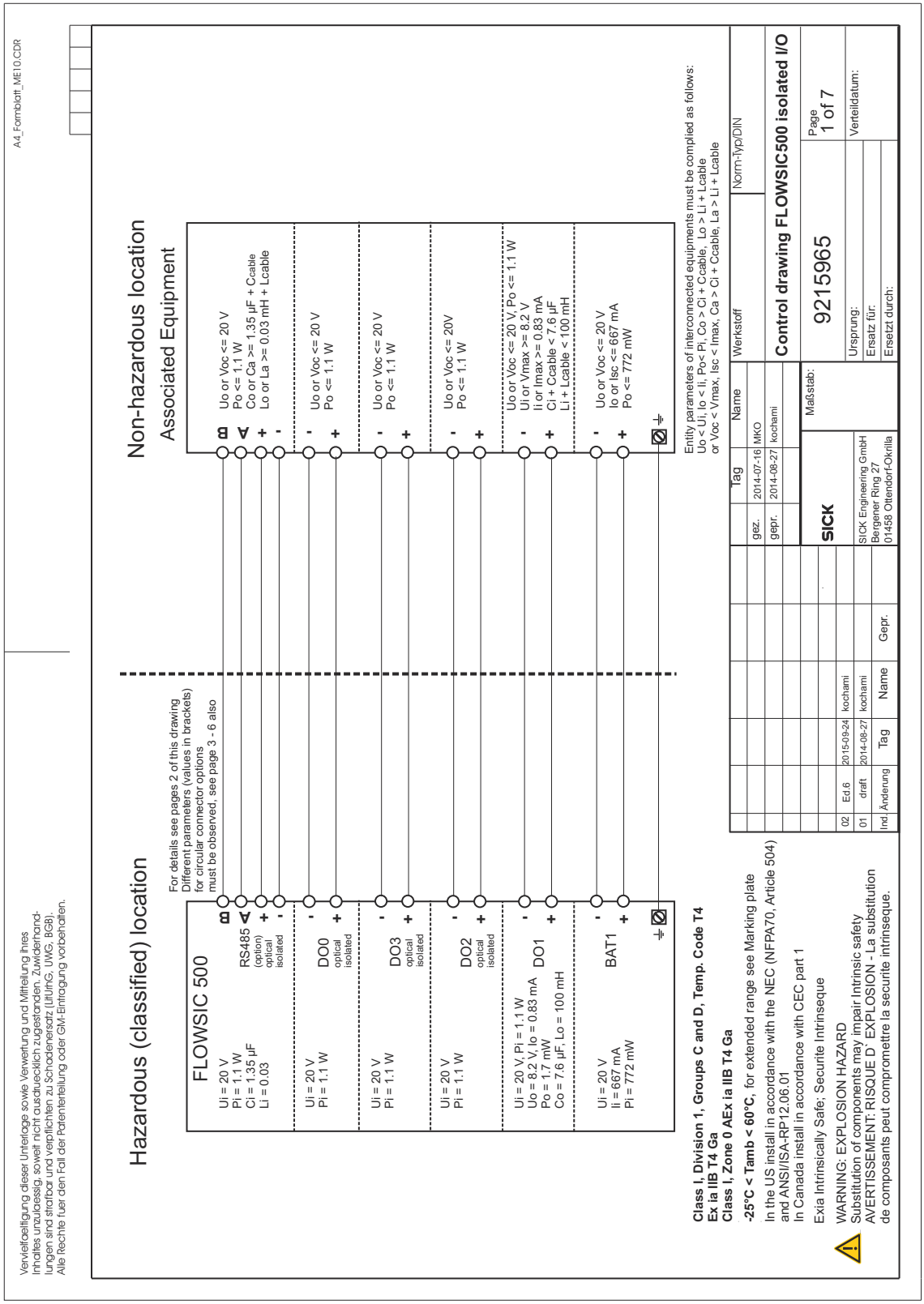


Fig. 52 Control diagram 9215965 (page 2)

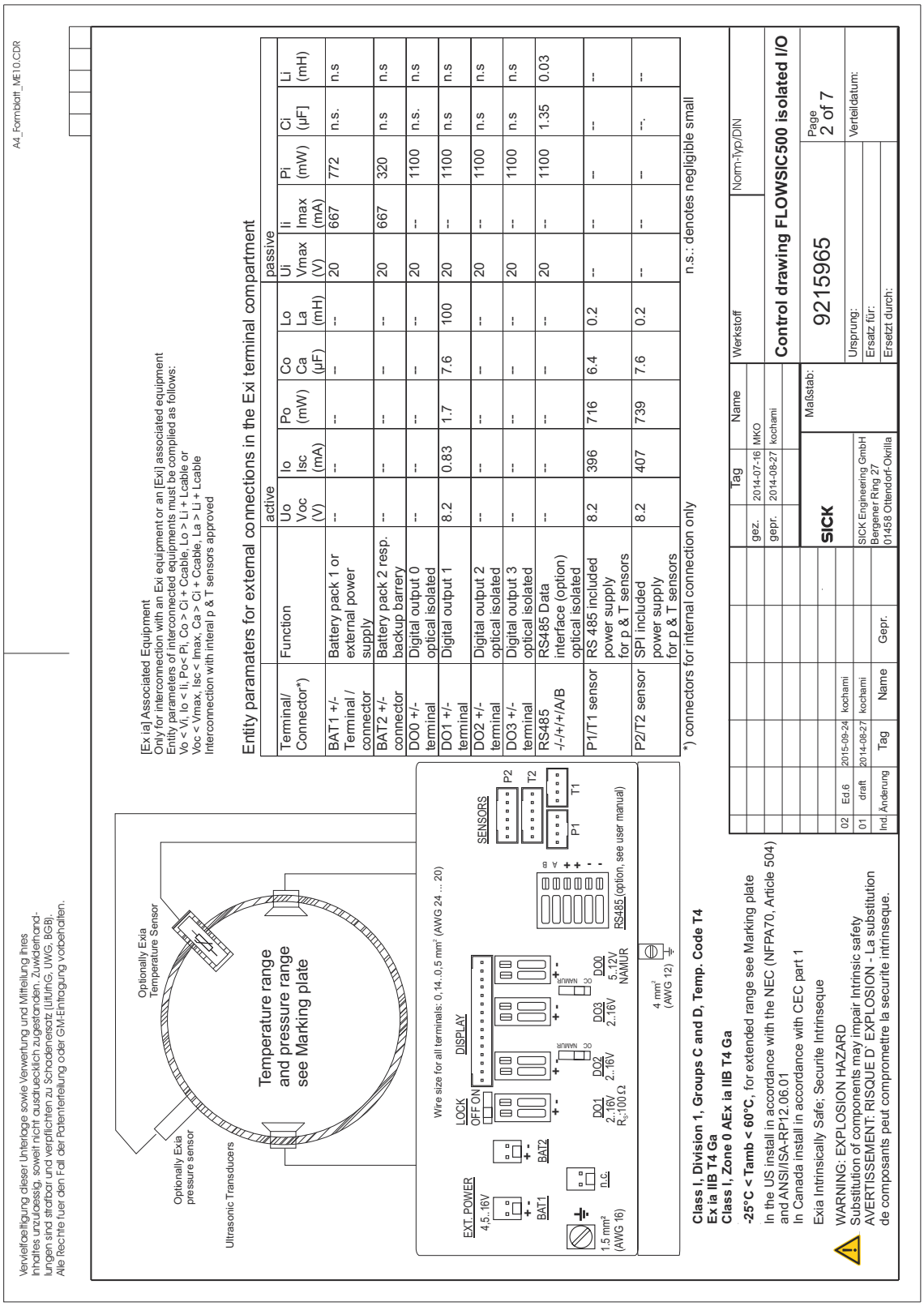


Fig. 53 Control diagram 9215965 (page 3)

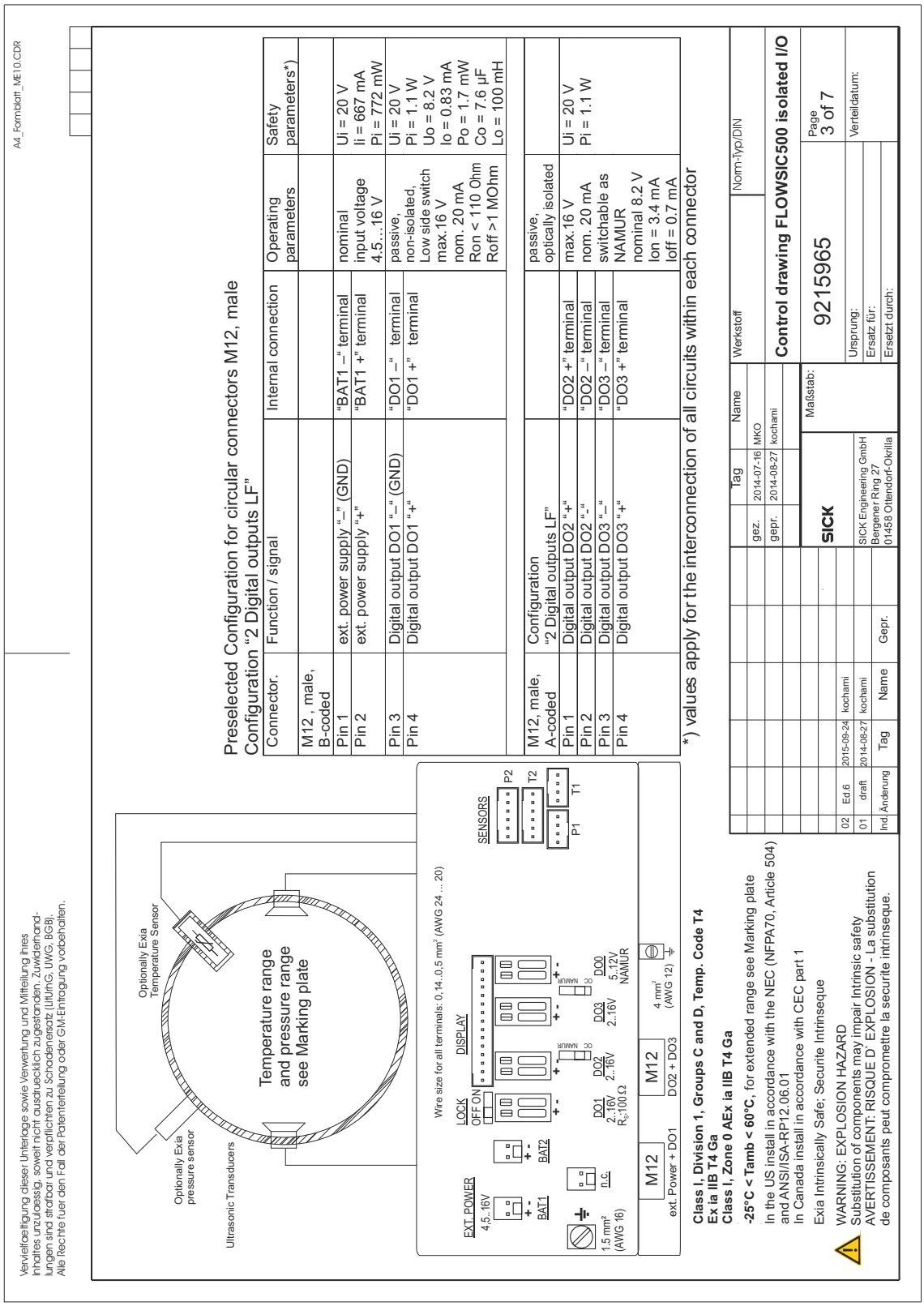


Fig. 54 Control diagram 9215965 (page 4)

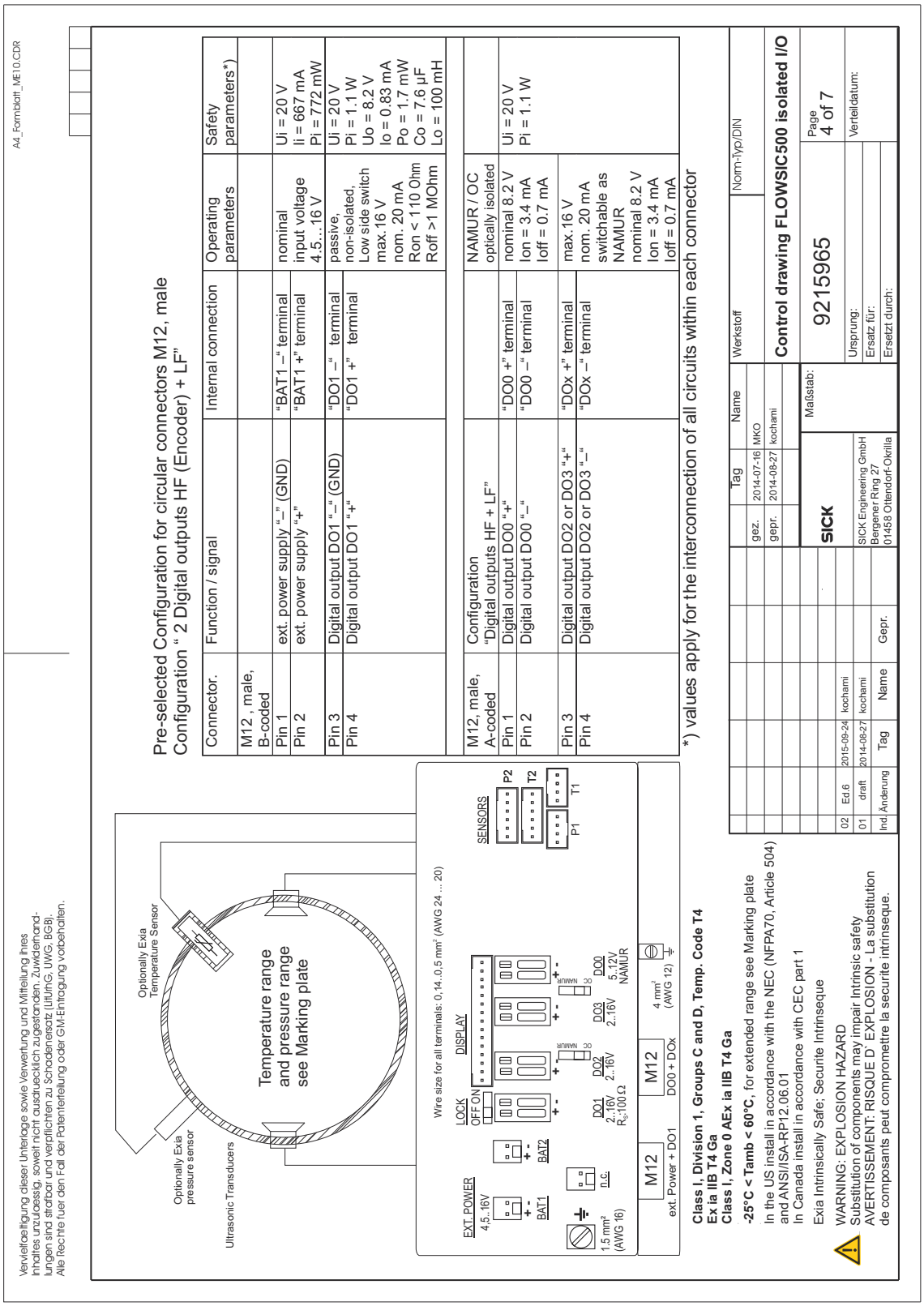


Fig. 55 Control diagram 9215965 (page 5)

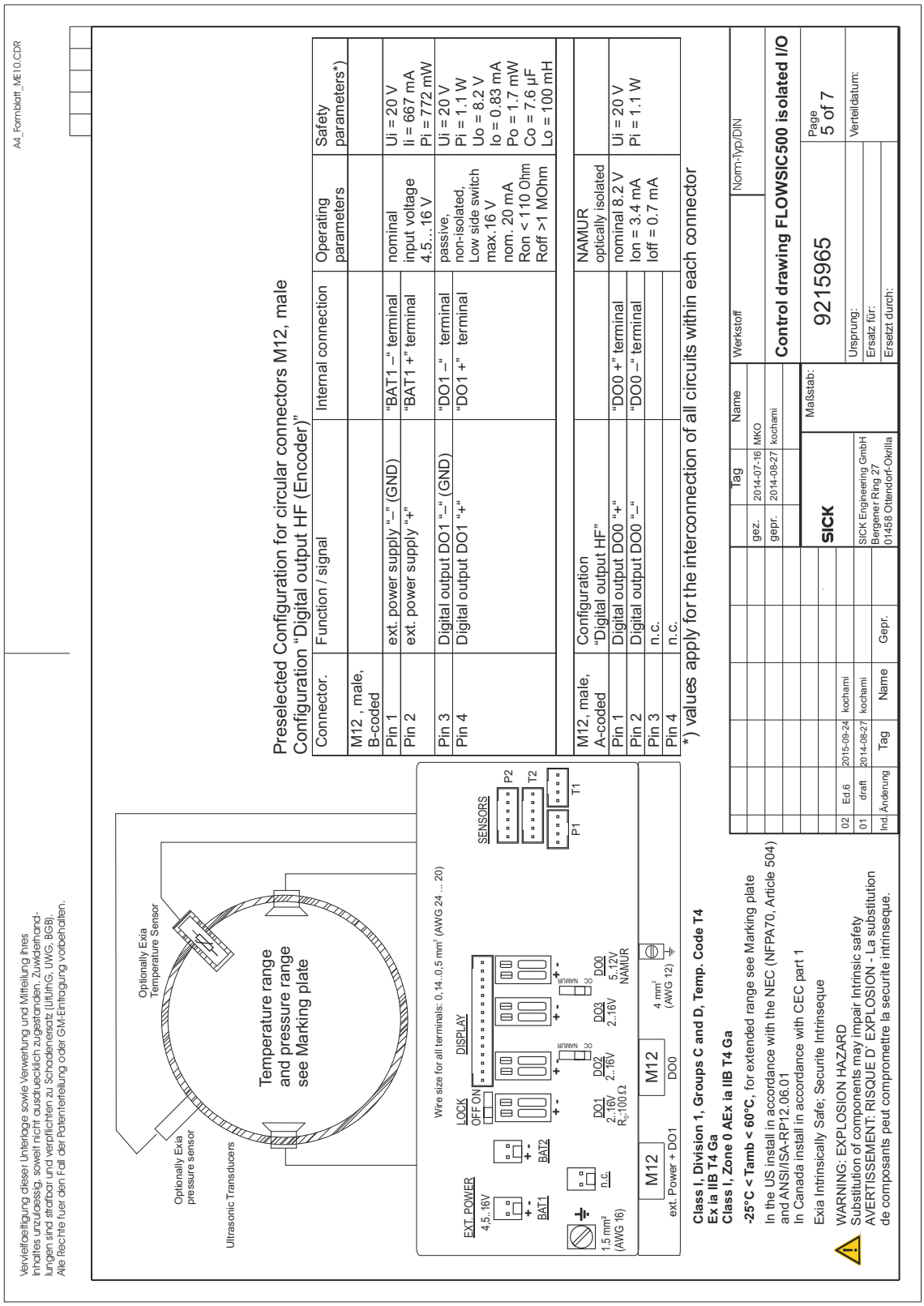


Fig. 56 Control diagram 9215965 (page 6)

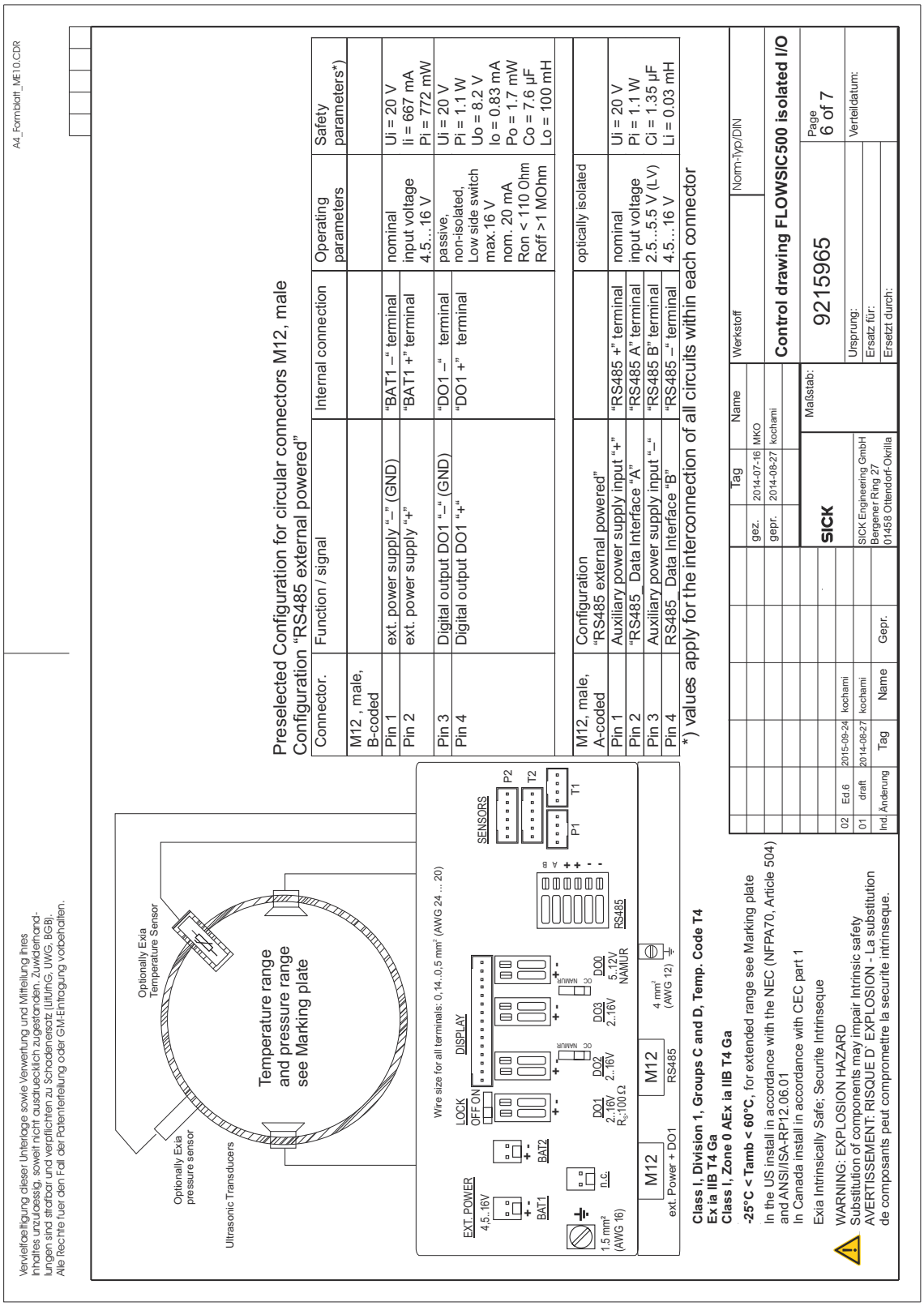
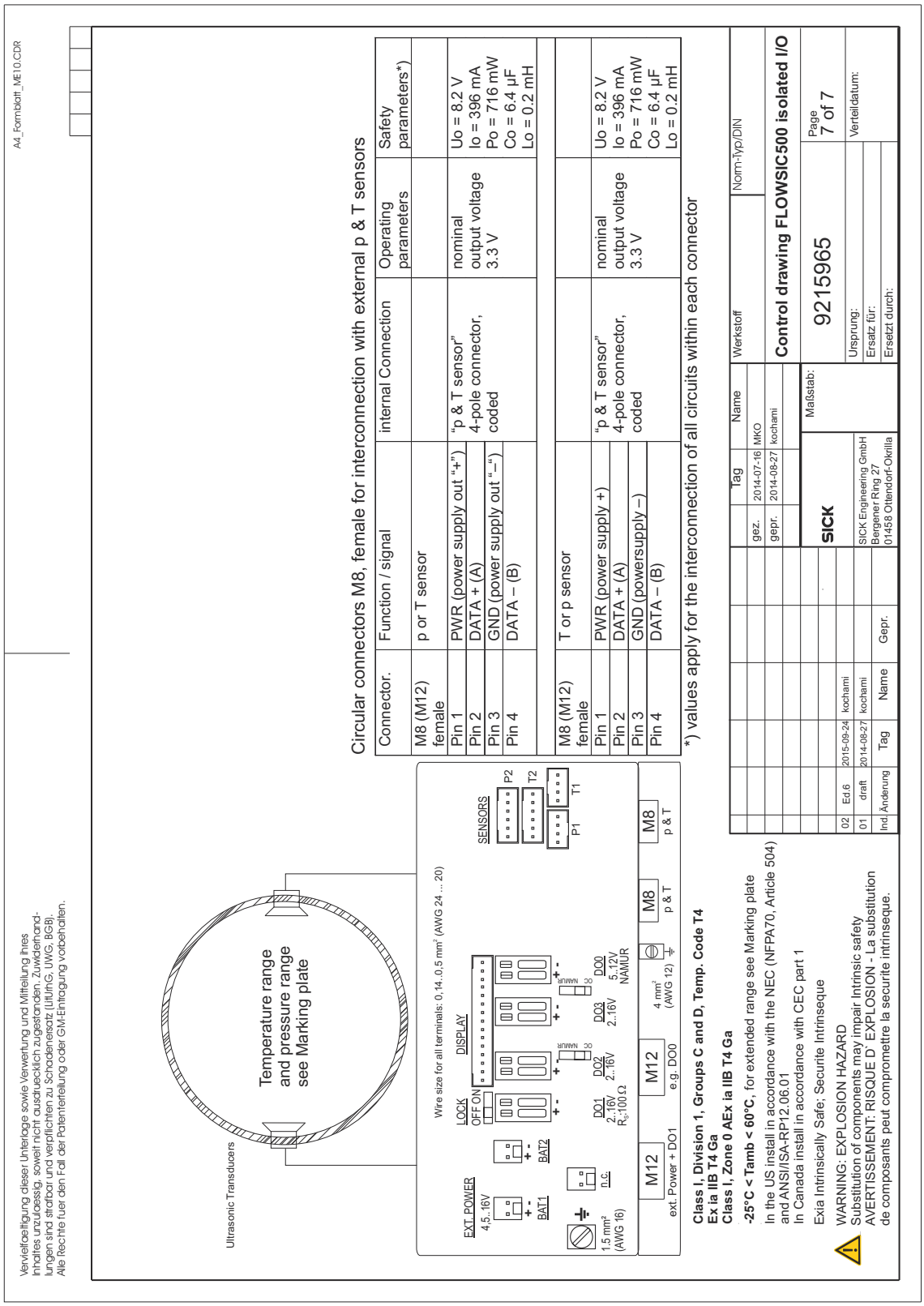


Fig. 57 Control diagram 9215965 (page 7)



9.8 Connection diagrams for operation of the FLOWSIC500 in accordance with ATEX/IECEx

Fig. 58 Control diagram 9215966 (page 1)

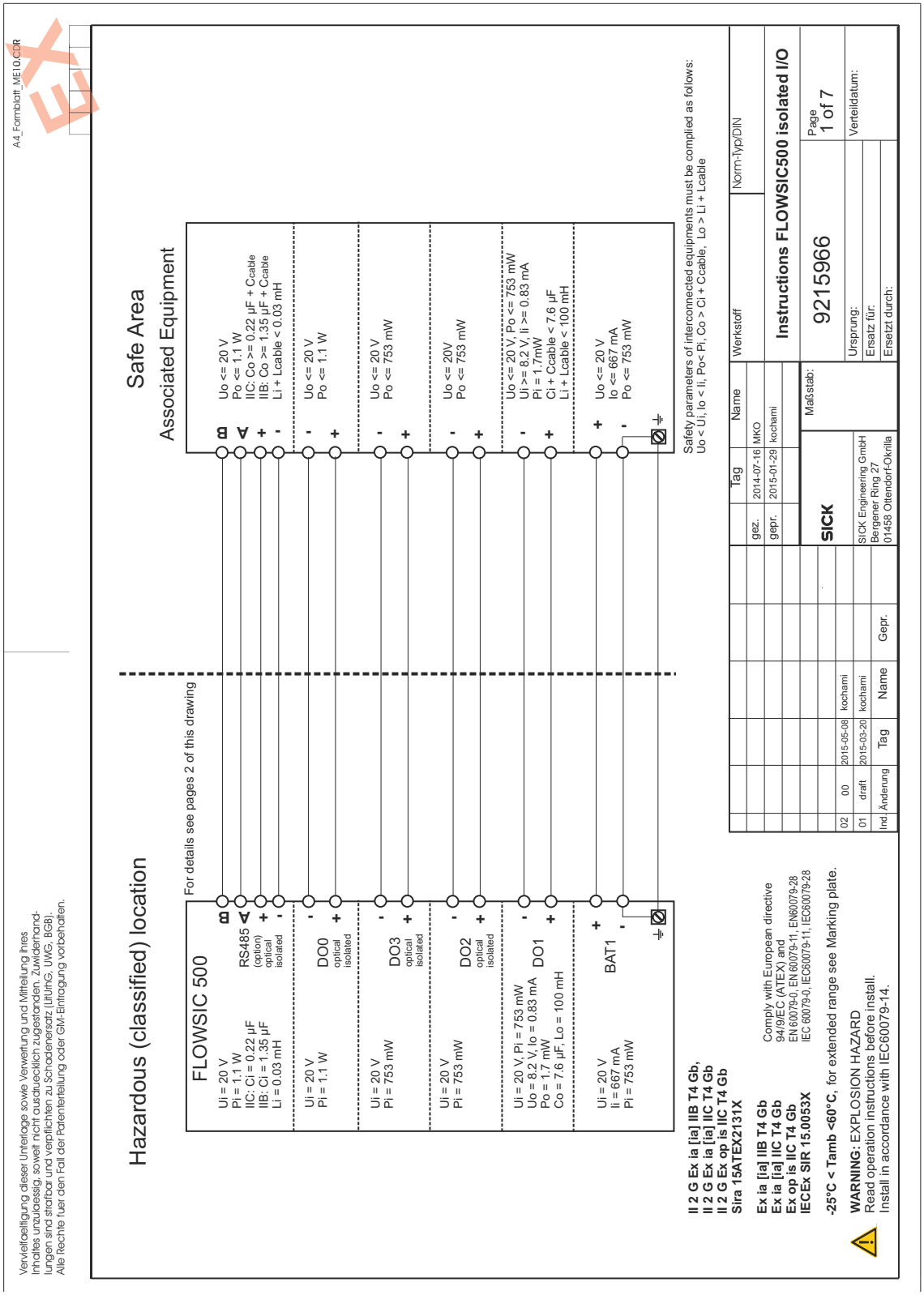


Fig. 59 Control diagram 9215966 (page 2)

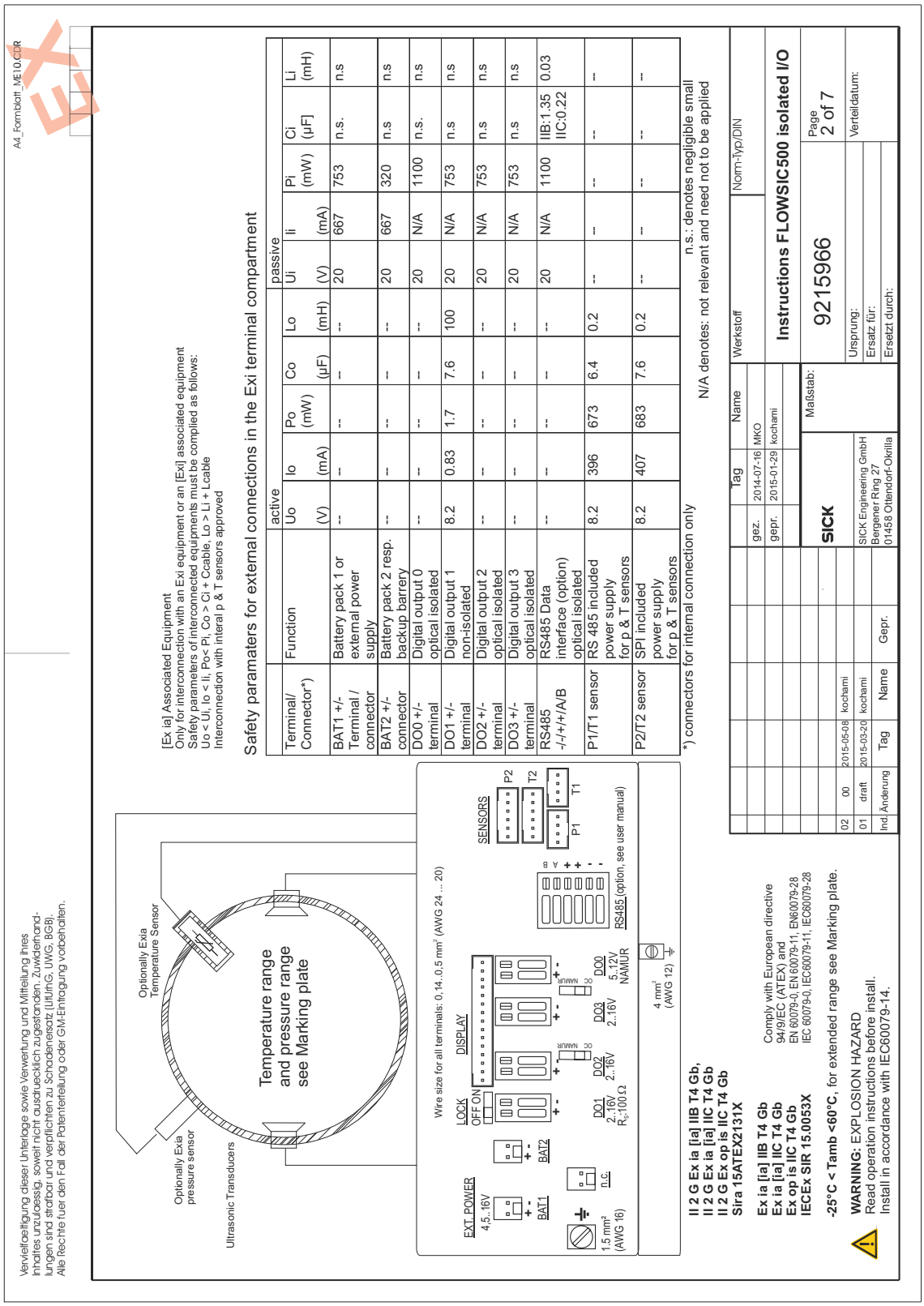


Fig. 60 Control diagram 9215966 (page 3)

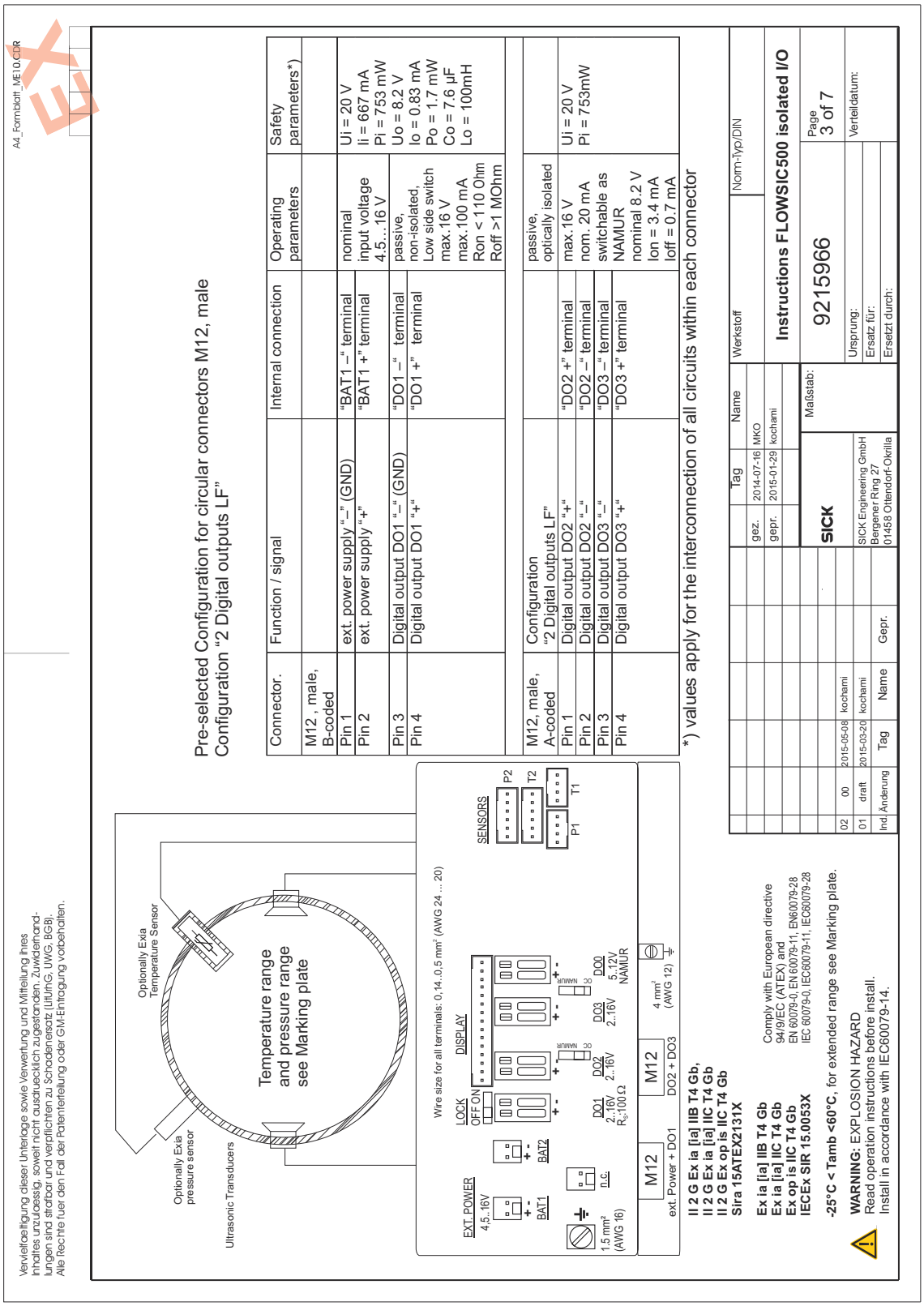


Fig. 61 Control diagram 9215966 (page 4)

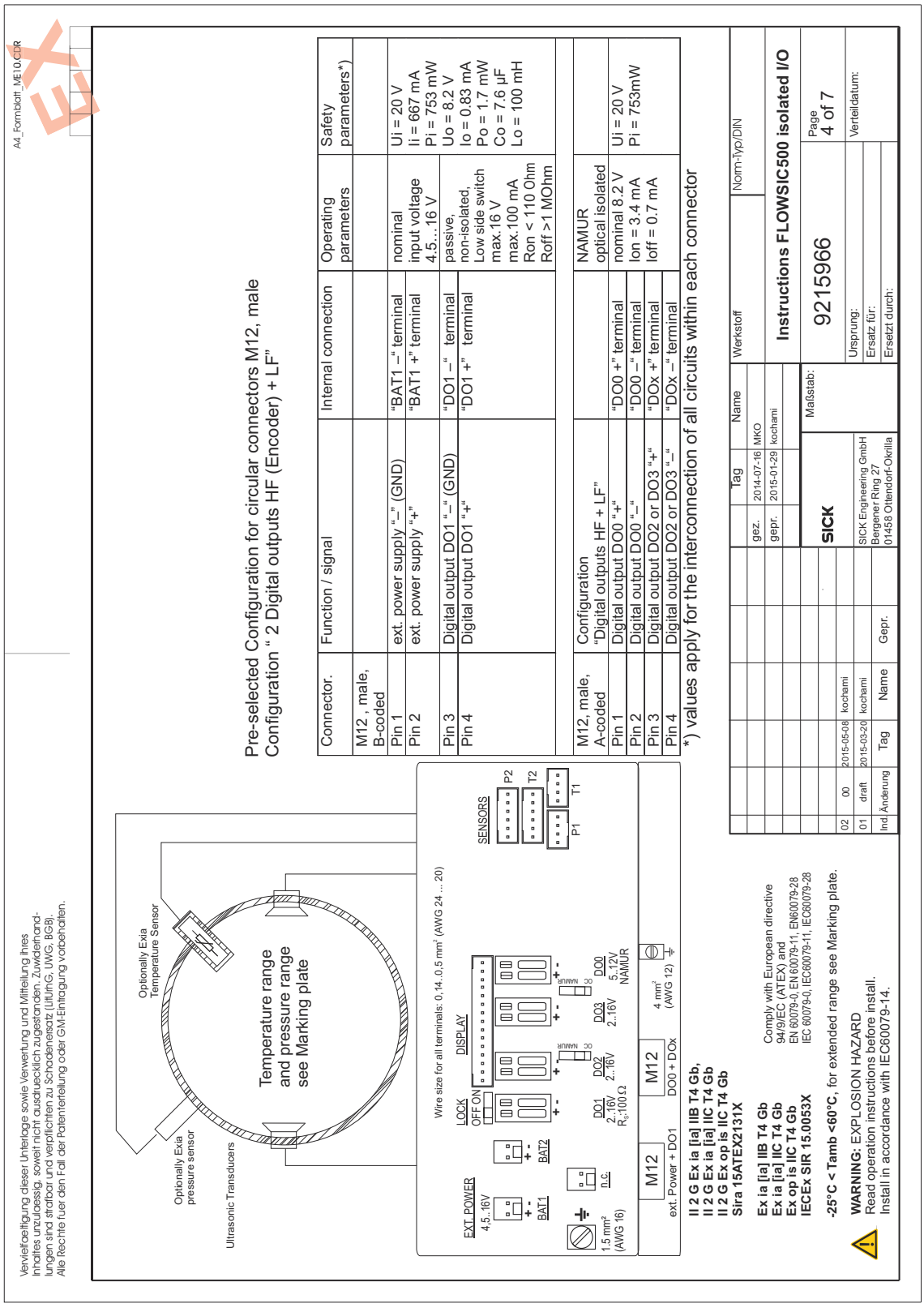


Fig. 62 Control diagram 9215966 (page 5)

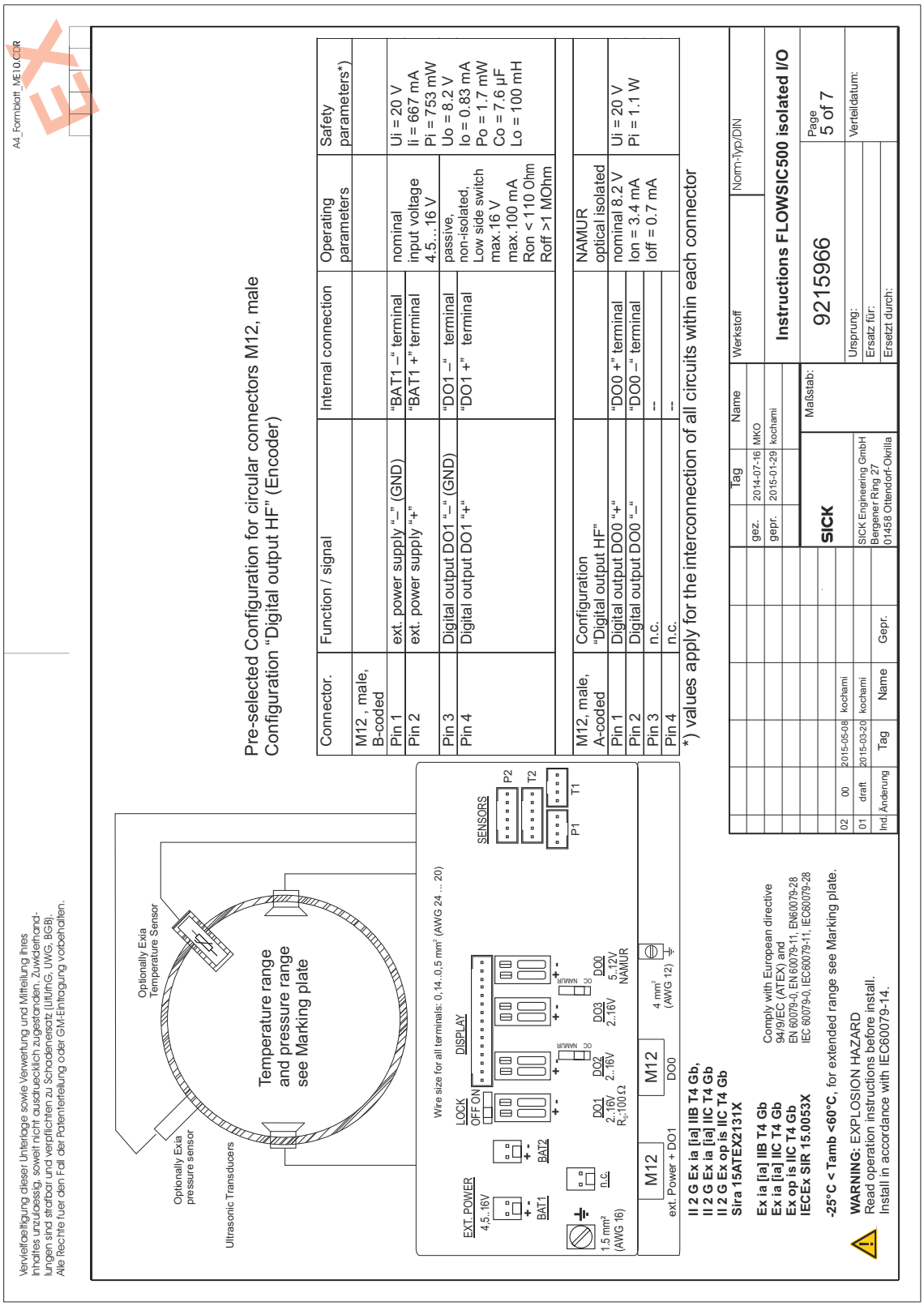


Fig. 63 Control diagram 9215966 (page 6)

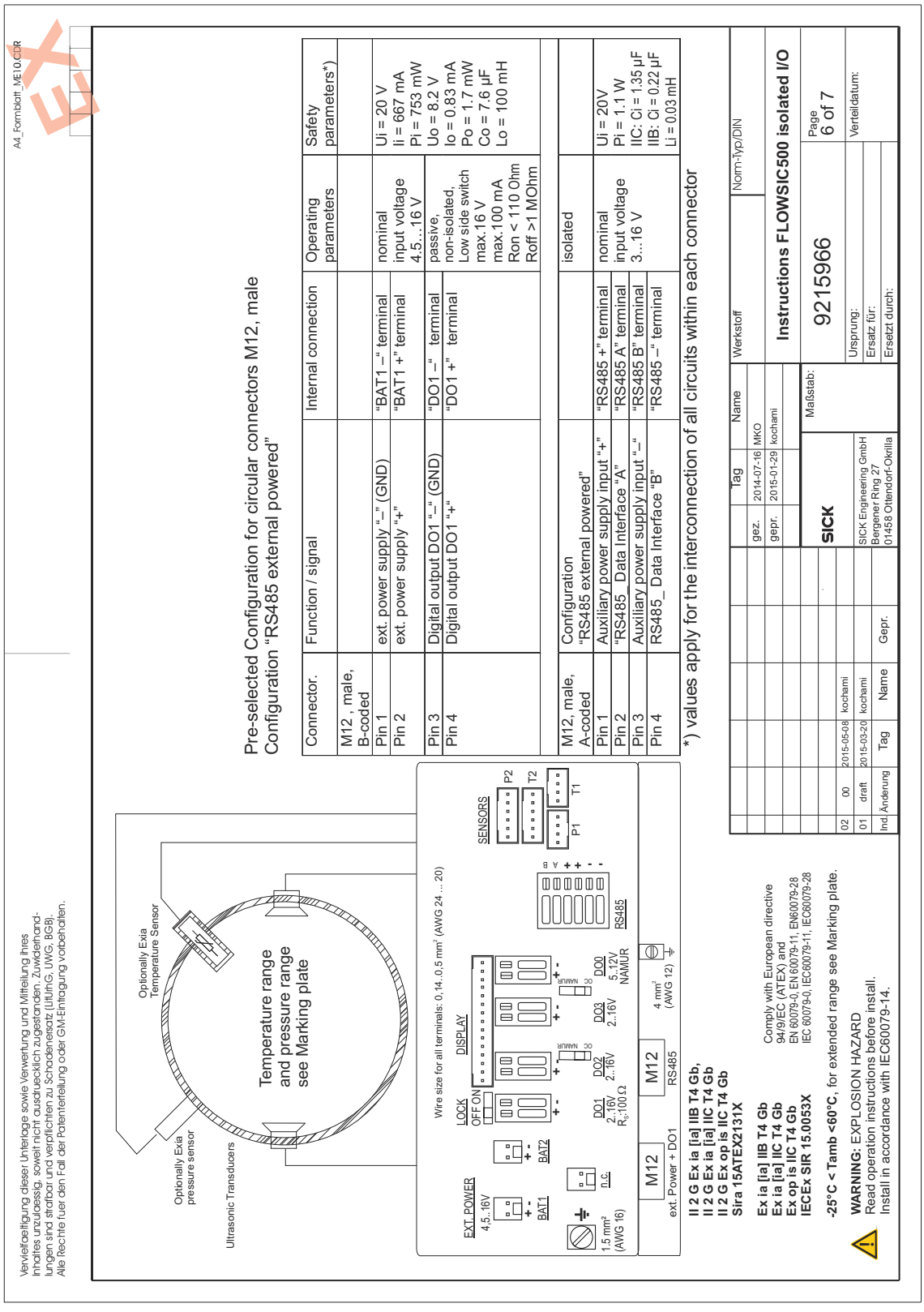
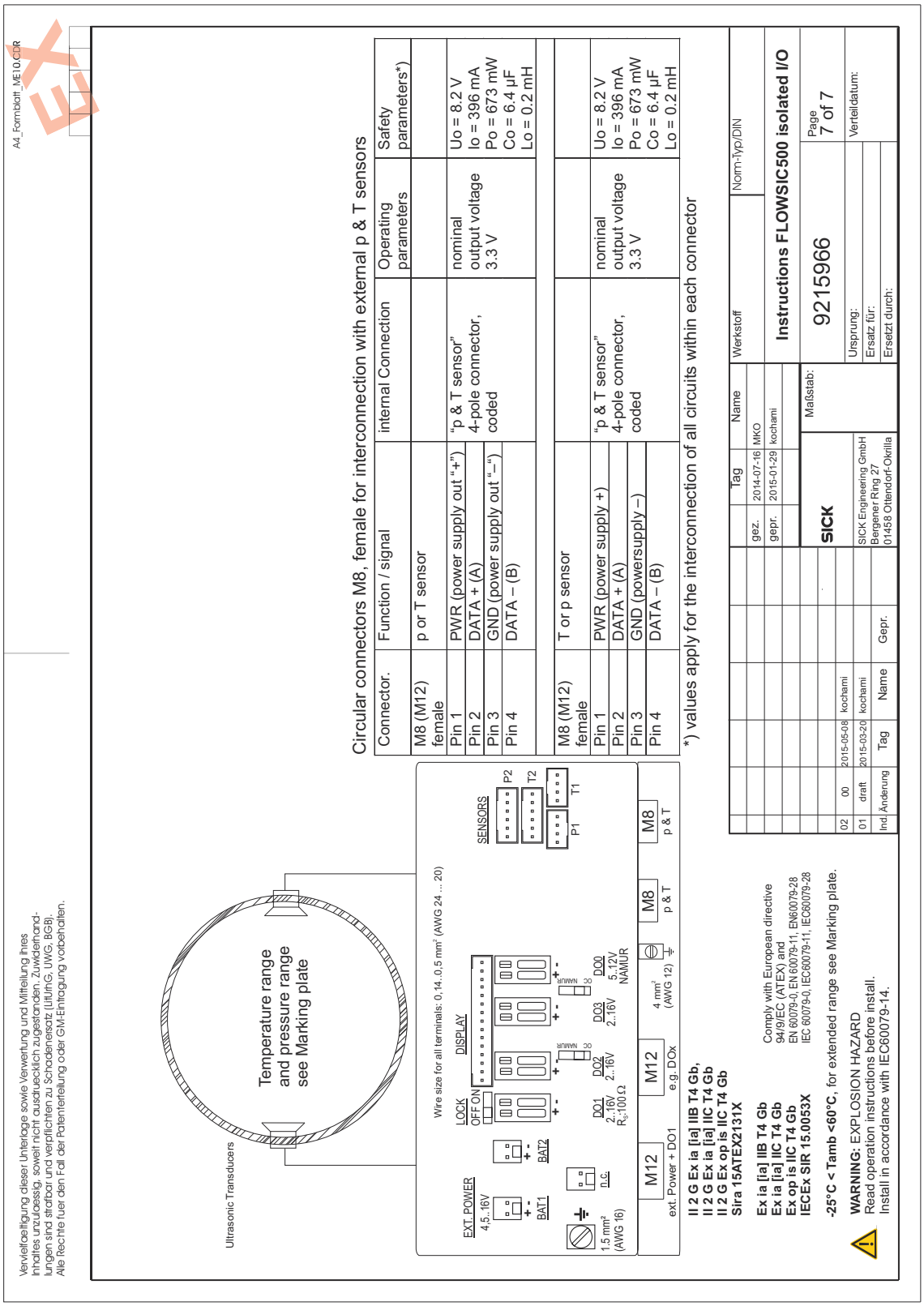


Fig. 64 Control diagram 9215966 (page 7)



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